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In this Issue

Message from Dr. Robert England

Editor, *International Fire Service Journal of Leadership and Management* and Professor Department of Political Science, Oklahoma State University

Welcome to Volume 2, Issue 1 of the *International Fire Service Journal of Leadership and Management (IFSJLM)*. This first issue of *IFSJLM* for 2008 is different from the previous two issues, which contained articles of general interest. In the world of academia, the name normally applied to an issue like Volume 2, Issue 1 is "Refereed Proceedings." That is, this issue contains the four articles presented at Research Symposium 06 (RS06) on July 8, 2006, in Tulsa, Oklahoma. The theme of RS06 was "Reducing Firefighter Line of Duty Deaths and Injuries (LODDs/Is): The Role of Leadership and Management." The Symposium supported the national initiative to reduce line of duty deaths and injuries among U.S. firefighters. The four papers presented at the Symposium included:

- "Developing a Safety Culture in the Fire Service," by Chief (ret.) William L. Pessemier, Department of Political Science and Fire Protection Publications, Oklahoma State University.
- "Applying Good Health and Safety Management at Operational Incidents: A Dilemma?" by Andrew Strawson, Health and Safety Advisor, Department of Communities and Local Government, Fire and Resilience Directorate, London, United Kingdom.
- "Safety Issues Associated with Operating Fire Department Tankers/Tenders," by Mike Wieder, Assistant Director and Managing Editor, Fire Protection Publications at Oklahoma State University, and Kevin Roche, Assistant to the Fire Chief, Phoenix, Arizona Fire Department.
- "Getting to the Heart of the Matter: Reducing Firefighter Line of Duty Death," by Walter Malo, Safety Program Manager, State Fire Marshal, Bureau of Standards and Training, Florida State Fire College and John DeIorio, Act. Fire Chief (ret.) and Academic Instructor, State Fire Marshal, Bureau of Standards and Training, Florida State Fire College.

The first two papers place the critical issue of line of duty deaths (LODDs) and injuries within a theoretical context. The latter two papers discuss, respectively, two of the most frequent causes of firefighter fatalities—tanker crashes and cardiovascular-related deaths. A panel of subject matter experts responded to each of the four papers at the Symposium. Subsequently, the authors revised their papers based on the reviewers' comments. In addition, based on the comments of anonymous reviews, the authors made final revisions to their papers.

In addition to the four articles, this issue contains the Keynote Address offered at the Symposium by Chief Ron Siarnicki, Executive Director, National Fallen Firefighters Foundation. Chief Siarnicki is in the forefront of the national effort to reduce the number of LODDs in the United States. His inspiring presentation provided an excellent overview of the issues and concerns associated with this important topic.

After each presenter summarized his paper, a panel of subject mater experts commented on the papers. Expert Panel members included:

1. Chief Dennis Compton, International Fire Service Training Association.
2. Chief Mark Jones, Deputy Chief Fire Officer, Essex County Fire and Rescue Service, United Kingdom.
3. Dr. Anthony Brown, Fire and Emergency Management Program, Department of Political Science, Oklahoma State University.

In addition, Chief Siarnicki responded to each of papers and offered suggestions for revisions to paper presenters. Chiefs Compton and Jones and Dr. Brown's comments on the papers are included in this issue.

We hope you find this special "themed" issue of IFSJLM thought provoking. Collectively, we must find a way to reduce LODDs so that **Everyone Goes Home**. Please send suggestions about other potential topics for future Refereed Proceedings of *IFSJLM* to **bob.england@okstate.edu.**

Delivered by Ronald J. Siarnicki, Executive Director, National Fallen Firefighters Foundation at *International Fire Service Journal of Leadership and Management Research Symposium*, July 8, 2006, Tulsa, Oklahoma

Reducing Firefighter Line of Duty Deaths and Injuries: The Role of Leadership and Management

Good morning. It is a pleasure to be here today representing the National Fallen Firefighters Foundation. As most of you are undoubtedly aware, the NFFF exists to assist the families of firefighters who are killed in the line of duty. This is, without question, our primary function as defined in our mission statement. In 1992, the Congress of the United States created the Foundation to provide information and assistance to families in this situation. Since then, we have helped thousands of families find their way through the maze of grief and bureaucracy that surrounds them after such an event. About 100 fallen firefighters are honored each October at the National Memorial in Emmitsburg — heroes who have died during the previous calendar year. About one hundred a year! Year in and year out this figure shifts slightly one way or the other, but historically for the past ten years the number of line-of-duty deaths (LODDs) have remained constant. Since the memorial was built 25 years ago, 3,047 firefighters have been honored, and their families assisted, by the National Fallen Firefighters Foundation. We are there to help during the early days (through our state response teams and by the training we have provided via the *Taking Care of Our Own* program) and we stay with our families for as long as they need our help. Because we have direct, undiluted experience with the families, it should not come as a surprise that the Foundation decided to no longer solely be involved with just these support functions. Because we have a collective perspective on the 100-plus families per year who are experiencing the pain of a line-of-duty death, we at the Foundation have taken a lead in finding a way to greatly lower the annual number of fire fighter fatalities that occur in this country. A hundred line-of-duty deaths a year is unacceptable. With the exception of the military and law enforcement, no other profession would tolerate 100 on-duty deaths per year. Unfortunately, some fire service members think differently. They said, "Hey, this is a risky business," or, "It's so dangerous that there are bound to be deaths and catastrophic injuries." But, this isn't what's killing firefighters.

Very few firefighters die as a direct result of fire suppression activities, and even fewer die doing something heroic. Firefighters are dying from heart attacks, because they drive too fast, or don't wear seat belts, or they don't follow the standards that would permit, for example, safe live-fire training. Firefighters are dying because they and others are making bad choices. To our great credit, we have designed apparatus, equipment and protective clothing that can address many situations that in the past did kill firefighters during fire incidents. But, if we drive like maniacs, do not use safety-rated equipment, and refuse to take heart-care seriously, we will continue to experience too high of a rate of LODDs. Because of those individuals who say "Well, maybe these deaths are inevitable," we gather today to re-frame that thinking. Believe me when I tell you that the vast, vast majority of firefighter deaths are preventable, and it all begins with leadership.

When I was asked to deliver this keynote address, I felt a heavy responsibility to familiarize myself on the most current literature regarding management and leadership. I thought I would begin by consulting sources to give me some ideas to frame my discussion. I typed *leadership* into Google and it came back with 831 million possible sources (I kid you not). So, I narrowed my search to "Fire Service Leadership" and Google came back with 28,300 hits (who knew?) So, Google really did not pan out since I did not have the rest of my life to do this research. Then I thought I would pick up a book or two on Amazon.com, but I discovered they carry 17,017 books on leadership. "Okay I said," that would not work either. I then turned to our own parent organization, the United States Fire Administration and asked its search engine to generate a report on what had been done "internally" on fire service leadership. Well, it turns out that between conferences and research papers written by graduates of the Executive Fire Officer Program, there were only 358 possible sources. Definitely not an impossible list to work through, but I did expect much more.

As I looked through much of this literature, I learned that there has been some good research done in this field of study. American society, including the fire service, loves to ruminate about leadership. See if these terms ring a bell: situational leadership, transactional leadership, transforming leadership, strategic leadership planning, and principle-centered leadership. Then we have management by objective, management by exception, and, my personal favorite, mission statements. But, little if any research tied to the root causes of firefighter fatalities has been undertaken, thus explaining why I am so pleased to be here today and involved in this research symposium. The fire service has developed a great group of "professional" leaders who can advise each of us on many leadership- and management-related topics. I respect each fire service individual who steps up to write about leadership. But,

it is a daunting task, and I think I know why. First, there is a tendency in the fire service to call something a leadership issue, when it is really a command or management challenge. We look for three-in-one, but that is often unrealistic. Most fire departments have people who are good managers, people who are exceptional and brave fireground commanders and others who are inspired leaders. That is not to say that commanders cannot become leaders; they can. It is just that people tend to have skill sets that point them in one direction or another. It has been my experience that when you ask an outstanding fireground commander if they would like to be a manager or leader of the organization, their reply is a resounding, "NO." Likewise, many of us who become chief officers probably know lower-ranking members of the organization who are much better at fireground tactics. This situation is okay.

A second reason we have a hard time narrowing a definition of leadership in the fire service is our peculiar "home grown" tendency to promote from within and accept what you have to work with. Searches for chief officers from "the outside" tend, generally, to occur only in mid- to large-metro departments. Small departments and most volunteer organizations do not have the financial ability to search for outside candidates. What happens in these departments is a sort of rough estimation on who could become the best leader. Then, this person is tasked with leading people with whom he or she was an equal to yesterday. I can tell you from experience that it is profoundly difficult to lead people with whom you were just recently conspiring. This is a difficult transition that occurs, unassisted, in fire departments across this country every day. So what does it mean to be a fire service leader? I do not have what social scientists would call a "unified theory" on this topic, but I am capable of knowing when I am in the presence of a great leader, a bad one, or even a dysfunctional one.

I can tell you that I have encountered effective leaders in every kind of fire department in the Untied States. Volunteer chiefs who learn to be so savvy at procuring resources for their departments they could rival Washington lobbyists. I have met leaders of metropolitan departments who are running organizations larger than many well-known for-profit corporations. These men and women have become experts in human resources, health care plans, workplace violence, and sexual equality. They are on top of all the things they need to know in order to be technically competent to manage a fire department; they know apparatus and equipment specifications, fireground management, safety and, unfortunately, how to handle a catastrophic injury or a line-of-duty death. The breadth and scope of what these leaders need to learn how to do is truly astounding. That so many of them do such a good job is a testament to how seriously they take up the mantle of leader (and manager and commander).

Finally, in my opinion, I think the search for fire service leadership has concentrated too much at the chief officer level and not at the junior officer level, especially in the realm of station leadership. Station officers and fire instructors are where the rubber meets the pavement in the fire service. You can try as a fire chief to set a good example and to be inspirational, but if junior officers do not share your mission, it is almost impossible to overcome their influence. Reducing line-of-duty deaths, especially, must be a shared leadership issue. The Alabama Fire College (2006) for example, defines leadership as "A process through which an individual influences others toward the accomplishment of common goals. It is dynamic, ever-changing, situational, evolving and it often involves a merging of values and perceptions." I really like this definition of leadership for our profession since it recognizes that leaders have to grow and that this growth takes place within dynamic organizations. The notion of common goals also intrigues me because although it may seem that our goals are obvious (protect life and property), the results are often uncertain.

So, what does this long preamble have to do with leadership and reducing line-of-duty deaths in the fire service? First, leadership is important. In *Toward a Theory of Military Leadership*, Charles F. Hawkins (2006, 4) writes, "…leadership is a real quality that is based on social interactions and perceptions of leaders and of followers. Military leadership does exist; it's not just a phase or a catchy slogan, and whether or not it is a natural or acquired ability, it is a human one and can be examined in terms of human relationships." For Hawkins, and many others who study leadership, the essence of leadership is action, the implementing mechanism for strategy.

As you know, and will hear many times today, the fire service had adopted a goal to reduce line-of-duty deaths by 25 percent in 5 years and 50 percent in ten years. This goal was set by the United States Fire Administration and adopted in 2004 by a consortium of 48 national fire service organizations at a meeting in Tampa, Florida. At that summit strategies were developed to help fire departments meet these goals. These strategies are what we call the 16 Fire Fighter Life Safety Initiatives. It is my contention that every fire service leader, manager, and commander has a huge stake in understanding, supporting and implementing these 16 Initiatives. This kind of leadership is not the big-issue leadership that most of the management books try to wrestle with. What I mean by leadership in regards to confronting line-of-duty deaths is what we could call "every person leadership." Every single one of us in the fire service — from the newest rookie to the most seasoned fire chief — has to be a leader when we confront LODDs. Each of us has to find the leader within in order to bring about this sea of change in reducing line-of-duty deaths. So this is what I mean

about leadership and LODDs. Everyone has a stake because we are all at risk of being killed on the job, or being impacted by a colleague's line-of-duty death. Moreover, many of us have family members in the fire service, which increases our risk that we will have to cope with a duty-related death. Leaders help to mitigate risks. We can all be leaders because we can all embrace and live the 16 Initiatives. I am not going to read you the initiatives. Being a group who is interested in reducing LODDs, I'm sure most of you are familiar with them anyway. As you know, the Initiatives address everything from the creation of national medical standards for firefighter fitness, to vehicle safety, to a greater focus on risk management, among other important issues. The Initiatives themselves are not particularly new or innovative. What is new is that for the first time almost the entire "formal" leadership of the fire service has come together to struggle with this issue. For the first time we are all on the same page where safety is concerned. This opportunity may never present itself again; we cannot miss this chance to make a difference. We are two years into the ten-year plan, and we must get focused and ask a million or more leaders to step forward.

I believe the most important Initiative is the first one: *Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability and personal responsibility.* What does this mean? In his essay, "Creating the 'New' Fire Service Culture," Bill Manning (2006, p. 1) argues that there is a disconnect in the fire service between leadership and full implementation of the 16 Initiatives. Culture change, he says, is viewed as a threat. Second, unsafe behaviors and attitudes have become regularized and are viewed as "tradition." Third, safety and mission are unbalanced within most organizations, meaning that we are willing to risk firefighters' lives when there is nothing meaningful at stake. Fourth, in the past the voices of safety within the fire service have been ignored or marginalized. If you are or were a fire chief, think about the people in your department who are always bringing up safety and risk issues. How were they regarded? And finally, Manning argues, we have not looked outside ourselves for help. The ideas and systems developed by behavior safety science have not been borrowed and applied into the fire service. As Manning points out through the remainder of his essay, complacency is the enemy of progressive culture change. Unless we can produce and support committed leaders at every level of the fire service, we will not reach our ten-year goal. The 16 Initiatives are for everyone who needs to be a leader in the field of firefighter safety — and this is every one of us. None of us has the luxury to sit back and think, "This will never happen to me." You know, a thousand fire chiefs probably said that in 2005, and a hundred of them lived the nightmare of a LODD. Many more are coping with firefighters who are seriously injured and who many never fully recover. You will never know the pressure to step up and be a leader until your department has suffered a catastrophic injury or a line-of-duty death. When I say that the 16 Initiatives are about leadership and finding the leader within each one of us, this is what I mean:

- Each of us can take responsibility for what we eat and if we choose to exercise. If we could give our members the ability to change just this one thing, we could meet our goal of significantly reducing firefighter deaths.
- Each of us can buckle up.
- Driver safety.
- Fireground Safety – Everyone has to be committed to safe fireground operations. Unsafe fireground operations, such as the inability to know where every firefighter is at all times, are inexcusable.
- Live-fire training, when properly conducted in accordance with NFPA 1403, and the use of simulators can prepare firefighters for a multitude of situations, such as flashovers.

Today you are going to hear four papers regarding the connection between leadership and the reduction of firefighter line-of-duty deaths. I look forward to each of these because real experts in their respective fields have written them. Beginning on June 21, 2006, most of you know, this nation's fire service observed its second national safety stand-down. A stand-down is a borrowed term from the military when all non-emergency operations cease in order to address an issue that has been identified as a problem. The point of the national fire service stand-down is to get fire departments to really focus on safety issues. This year's theme was vehicle safety.

Over the past year, the NFFF and several sponsors have been developing the Firefighter Life Safety Resource Kit. This kit, which contains six original videos and support material, is aimed at reducing firefighter line-of-duty deaths. It was mailed to every fire department in the United States to be utilized during the week of the stand-down. In preparing this material, we interviewed thirty fire service leaders, from all ranks, and asked them their views on how fire service leaders can impact the mission established by the USFA.
Thank you for this opportunity to address Research Symposium 06. I am so happy that you have joined our mission to reduce line-of-duty firefighter deaths.

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About the Author

Chief Ronald Jon Siarnicki is the Executive Director of the National Fallen Firefighters Foundation (NFFF), a position he has held since 2001. Prior to 2001, he was the Chief Fire Officer of the Prince George's County Fire/EMS Department which he joined as a rookie firefighter in 1978. In addition to his outstanding professional development, Chief Siarnicki holds a bachelors degree in Fire Science (University of Maryland) and a master's degree from the School of Management and Technology (University of Maryland-University College). He has served as a UMUC faculty member for the Fire Science Curriculum for nine years. In addition to his academic degrees, he is also a certified Fire Officer IV, Fire Fighter Level III, and State Emergency Medical Technician. The National Fallen Firefighters Foundation assists families and coworkers of firefighters who have been killed in the line-of-duty. As Executive Director of the NFFF, Chief Siarnicki is responsible for all aspects of managing the Foundation, including long-range planning, fundraising, and the development of outreach programs for survivors. In this capacity, the NFFF assists family members as they learn to live with the loss of their firefighter by providing many forms of grief counseling, as well as advice on obtaining financial benefits. The Foundation also helps fire departments who experience a line-of-duty death. In recent years, the Foundation has developed the Everyone Goes Home initiative, a national education and training program aimed at preventing future firefighter deaths. Ron can be reached at: **rsiarnicki@firehero.org**.

William Pessemier, Department of Political Science and Fire Protection Publications, Oklahoma State University

Developing a Safety Culture in the Fire Service

Abstract

Firefighter deaths and injuries in the line of duty continue to occur at an unacceptable level. Despite changes and improvements in protective clothing, equipment, apparatus, standards, procedures, and practices the rate of firefighter deaths in the United States has actually increased by approximately 34 percent, from 4.94 firefighter deaths per 100,000 fires in 1995, to 6.64 firefighter deaths per 100,000 fires in 2004. The purpose of this paper is to provide a summary of the concepts associated with the construct of safety culture. The Reciprocal Determinism Model is used as the basis for the construct of safety culture within the context of the fire service. In addition, an overall framework is proposed that provides a basis for understanding the relationship between safety culture and organizational identity and how organizational identity can influence the adaptive response of an organization to pressure for change in its safety culture.

Introduction

The relatively high rate of firefighter deaths and injuries in the United States fire service continues to be problematic. Various procedural, technical, structural and behavioral changes and improvements have been made in the last few decades with the intention of improving firefighter safety. However, the rate of firefighter deaths per 100,000 fires has actually increased by 34% from 1995 to 2004, from 4.94 to 6.64 respectively. The methods and approaches used so far have not been effective or successful in reducing firefighter deaths.

Other industries are also concerned with safety and the potential for death and injuries and have been able to demonstrate significant improvements in safety performance. These include the nuclear power, mining, shipping, hospital, air transportation, and chemical industries. The military also has been able to develop highly reliable organiztions in high-risk environments, such as aircraft carrier flight deck operations. These industries have used the concepts and principles of a safety culture to help improve their safety performance. The thesis advanced in this paper is that it is time for the fire service to do the same.

The purpose of this paper is to provide a summary of the concepts associated with the construct of a safety culture for the fire service. A description of the concepts of organizational and safety culture is provided and the relationship between safety culture and organizational performance is explored. In addition, the concept of organizational identity is developed, of which culture is one component. The concept of identity carries with it some dysfunctional aspects, and these are also discussed in the context of the development of a safety culture. A model of the relationship between organizational identity, self identity, and adaptive response to change is proposed in the context of safety, and recommendations are made for developing a safety culture in the fire service.

The Safety Problem in the US Fire Service

In the US, over the period from 1995 to 2004, the firefighter death rate has actually increased per 100,000 fires from five firefighters per 100,000 fires to almost seven firefighters per 100,000 fires (NFPA, 2004). In comparison, the number of firefighter deaths in both the United Kingdom and New Zealand over this same period is less than one firefighter per 100,000 fires (ODPM, 2004; NZ Fire Service, 2004). Despite differences between how the US and these other countries determine whether a firefighter death is fire related or not, this is an astonishing difference in the number of firefighters who die in the line of duty.

Over the last several decades, a number of changes have occurred in the fire services that have been intended to increase firefighter safety and to reduce firefighter deaths and injuries. Improvements have been made in protective clothing and equipment, apparatus, procedures, standards, codes and ordinances, as well as in the process of command, control and communications. Despite these improvements, the firefighter death rate has continued to increase. These changes have been directed at the procedural and technical aspects of safety, without much success. It may be time to take another approach to reducing line of duty deaths. One approach that has been used successfully in other high-risk industries is based on efforts to change the culture of the organization.

Safety in the Context of Organizational Culture

Developing the Concept of Safety Culture

The term safety culture was first used in the accident investigation of the Chernobyl nuclear power plant incident of 1986. It has since been used in other accident reports, including those involving aviation accidents and the Columbia space shuttle disaster. The concept of safety culture is the most recent stage in the development of safety management thinking and theories of system failures and accident causation. Over the last few years, these stages have included the technical period, the human error period, the socio-technical period, and the current period focusing on organizational culture (Weigmann et al., 2004). In each of these stages, a different approach was taken towards accident investigation and analysis. In the technical period, the focus of accident causation was on technical and mechanical systems and the design, construction, and reliability of equipment. For the fire service, this might include efforts to improve the safety-related features of building construction and the reliability or functionality of fire fighting equipment.

The focus of the human error period was on the faults or mistakes of human operators rather than mechanical or technical failures. Cognitive limitations of individuals were the focus of these efforts, for the purpose of assigning blame or responsibility to the people most directly involved in the unsafe act. Examples from the fire service might include accident investigation reports that point out the failure of decision making by command officers or individual firefighters that lead to unnecessary casualties on the fireground.

Socio-technical errors were the next stage in the progression. In this period, errors were viewed as the result of a combination of human and technical failures or breakdowns. Current literature on safety management has focused on the concept of organizational culture as a critical factor in organizational safety. People in organizations operate within the context of a particular culture that influences the attitudes and behaviors of those individuals with regard to safety issues.

Organizational Culture

In much of the safety management literature, safety culture has been described as a component of organizational culture. Organizational culture is defined by Schein (1992) as:

> a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems. (p.12)

While there is no consensus on the exact definition of organizational culture, the common theme is that organizational culture reflects behaviors, values, beliefs and assumptions that are shared by members of the organization about the organization's mission, goals, practices and procedures. This does not preclude the existence of subcultures within organizations, which are groups of members who hold different values and assumptions from those that are used to characterize the organization as a whole. However, the assumption is that for most organizations, a single dominant culture is present that provides the basis for how people in the organization think and behave.

Based on what has been learned from the research on organizational culture, Guldenmund (2000) provides a summary of the relevant characteristics of organizational culture. He proposes that organizational culture is an abstract social construct, which results in some difficulty in how to define and operationalize the variables associated with the construct. While the characteristics of culture are relatively stable within organizations over a period of several years, they are also multidimensional. That is, a number of different dimensions or variables can be used to define and measure culture.

Organizational culture is shared by members of the organization, but the dominant characteristics may vary with the level of analysis or the level of the organization, which gives rise to the possibility of sub-cultures within larger organizations. Organizational culture can be differentiated into different categories or types, such as safety culture or service culture, which are manifested through practices and behaviors that reflect organizational norms, values, and beliefs. The functional purpose of these practices is to provide a behavioral frame of reference for members of the organization. This frame of reference is used to deal with problems of external adaptation and internal integration.

Schein (1992) provides a framework for analyzing culture through observable elements that are organized on three levels. The first or outermost level is that of artifacts. These are the visible organizational structures, processes and practices. The second level is that of espoused values. These include the shared values, beliefs, strategies, goals, mission and philosophies of the organization. At the deepest level are the basic assumptions that form the values and beliefs upon which behaviors are based. Basic assumptions are unconscious, taken-for-granted perceptions, thoughts and feelings.

It is the basic assumptions developed within the context of organizations that tell members how to perceive, think, and feel about the issues confronting the organization. Once these assumptions have been established, organizational members will defend them rather than allow them to be challenged and changed. Schein (1992, 22) states that rather than tolerate the anxiety associated with changing our basic assump-

tions, people will want to perceive events as consistent with these basic assumptions, even if this means "distorting, denying, projecting, or in other ways falsifying to ourselves what may be going on around us." This is the reason it is so important for the fire service to understand the concept of safety culture. One of the reasons that the US fire service may be suffering from such high rates of casualties in terms of line of duty deaths is because we may be distorting, denying, or falsifying to ourselves what has been happening with regard to firefighter deaths. As a result, safety culture may be the most important and most overlooked factors influencing safety performance in the fire service.

Safety Culture

Safety culture exists within the broader context of the organization. Several studies use Schein's work on organizational culture as the framework for the development of the concept of safety culture (Guldenmund, 2000; Wiegmann et al., 2004; Hopfl, 1994; Glendon et al., 2000; Cooper, 2000). Based on the overarching definition of organizational culture provided by Schein (1992), safety culture has been defined in several ways. Pidgeon (1991) defines safety culture as those beliefs, norms, attitudes, roles and practices that are concerned with minimizing the exposure of employees and members of the public to dangerous conditions. Guldenmund (2000) defines safety culture as the aspects of organizational culture that impact on attitudes and behaviors that are related to increasing or decreasing risk. Parker et al. (2006) define safety culture as a subset of organizational culture, specifically those beliefs and values that involve safety and that relate to the ability of individuals in organizations to make decisions about risk and hazards so that damage and loss are avoided while still achieving their goals.

While no consensus has been reached on the specific definition of a safety culture, a number of common elements have been identified in the literature. Safety culture is a construct that involves shared values among groups of organizational members. Establishment of a safety culture involves the development of a formal management and supervisory system for dealing with safety issues. Also, the organizational approach toward the concept of safety involves shared responsibility throughout the organization. A safety culture becomes apparent in an organization through its effects on the behavior of members in the work environment. Within a safety culture, organizational rewards are contingent upon safety performance, while at the same time, the organization is willing to learn from errors, incidents, and accidents. Lastly, a safety culture is enduring and stable within the organization (Wiegmann et. al, 2004).

Establishing a definition of safety culture provides the framework for delineating the purpose of a safety culture. Cooper (2000) provides a summary of the purposes of a safety culture, which includes the following: establish behavioral norms; reduce accidents and injuries; prioritize safety commensurate with its significance; develop shared ideas and beliefs about risks, accidents and injuries; increase members' commitment to safety; and determine the effectiveness of the organizational safety management system. Analysis of an organization's safety culture provides the means for measuring whether these purposes have been accomplished.

Safety culture can be analyzed in the same way as organizational culture, by examining safety-related behaviors and practices, determining safety-related values and beliefs, and uncovering the underlying assumptions related to organizational safety (Cooper, 2000). Safety behavior and practices can be measured using checklists, peer observation, self-reports, or safety outcome measures. Values and beliefs can be measured using any of a number of safety climate questionnaires or surveys. Underlying assumptions are difficult to examine because they are unconscious. However, these assumptions are manifest through the values, beliefs, behaviors and practices that are held by organizational members or that occur within the organizational context. Representations of the underlying assumptions of the safety culture are reflected in the policies, structure, control systems, and management practices of the organization.

Problematic Aspects of Culture

Development of a distinct and strong organizational culture clearly has benefits for organizations. However, organizational culture also carries a specific set of problems, conflicts and contradictions that have been identified in the safety-related literature.

The fire service operates in an unusual context. In most industries, the higher the level of safety of organizational members, the higher the level of safety for others. In the fire service, there is a perception that the higher the level of risk that is taken by firefighters, the higher the level of safety of those who might otherwise perish in a fire. However, many professions and industries operate near the edge of safety: that point between the greatest risk and the greatest reward (Reason, 2000).

Operating near the edge of safety represents a conflict between two competing goals. The first is to provide effective service delivery, which means being able to rescue civilian casualties in a fire. The second is to provide for firefighter safety. Operational safety is a tradeoff between an appropriate and acceptable level of risk taken by firefighters to extinguish fires and rescue or protect civilians and the level of safety required to prevent firefighters from becoming casualties themselves.

How does culture influence the decision-making process and the ability of decision makers to weigh the level of risk against the level of safety? Culture is based on shared assumptions, beliefs, values, and norms

as a way of establishing common meaning among the members of the organization. Culture also serves to establish, regulate and reinforce the structure, processes and practices that occur within the organization. This results in standardized patterns of behavior. Shared meanings have the effect of strengthening each member's beliefs in their own social constructions. This can become problematic for safety when members of the organization begin to unquestioningly believe their own messages about their current thinking about safety and the effectiveness of safety practices. Within the context of common social constructions and shared meanings, such thinking limits the search for information that is not consistent with current social constructions and shared meanings (Hopfl, 1994).

In pursuit of consensus, culture functions to hide information and to conceal dysfunctional practices. As conflicts arise between performance and safety, many organizations choose to take a bureaucratic approach to safety and establish rules and procedures. A relatively high standard of safety is developed on paper, but what happens in actual practice may be quite different. If safety practices and procedures are not considered to be relevant to performance, then actual behaviors may produce the appearance of conformity to safety standards while actually neglecting safety practices. Therefore, it is important to understand not only what is revealed by organizational culture, but also what is concealed.

Dimensions/Elements of Safety Culture

A number of different elements or dimensions have been used in the literature on safety culture to describe a good safety culture, and effective safety culture, and the main elements or general components of a safety culture. General concepts that have been used to describe safety culture include the development of norms and values for dealing with hazardous conditions, the presence of appropriate attitudes towards safety, and a learning process associated with safety (Pidgeon, 1991).

Norms and values shape the perceptions of organizational members about what represents a significant risk and what the appropriate response to such risks should be in terms of individual behavior and acceptable organizational practices. Collective beliefs about the nature of occupational hazards and the importance of safety and safety practices form the organizational attitudes toward safety. Risk usually involves some degree of uncertainty and ambiguity that results in errors or mistakes. A willingness to learn from mistakes by applying that learning to change practices and beliefs in order to improve safety performance is also an essential component of a safety culture.

More specific dimensions of safety culture are described extensively in the literature on safety culture, and so are only listed briefly here. Wiegmann et al. (2004) describe these as organizational commitment, management involvement, employee empowerment, reward systems, and reporting systems. Elements of an effective organizational safety culture have been described by Reason (1997) and include the following: a culture that supports the collection of safety information from incidents, near misses, and proactive safety checks; a reporting culture where people report their own errors and mistakes; a culture of trust where people are encouraged to provide important safety information and where clear delineations exist between acceptable and unacceptable behavior; a flexible, dynamic organization open to change in response to external demands; a competent organization that is able to develop logical and objective conclusions from safety information and is willing to implements change when required.

Safety Culture and Safety Performance

Establishing a definition of safety culture, understanding the framework for analyzing safety culture, and describing the elements or dimensions of safety culture are all necessary in order to provide the foundation for changing the culture within the fire service so that significant improvement can be made in safety performance. The purpose behind a greater understanding of the construct of safety culture is to be able to change the underlying assumptions associated with safety in the fire service so that safety-related values, beliefs, and behaviors can also be changed. The consequence of the current culture in the fire service has been what could arguably be called the unnecessary deaths of hundreds of firefighters. It can be anticipated that the consequences of establishing a safety culture in the US fire service will be a significant reduction in the number of firefighters who die in the line of duty.

Safety performance depends on psychological, behavioral, and situational variables (Cooper, 2000). The interaction between these variables can also influence safety performance. The concept of reciprocal determinism is drawn from Social Learning Theory and Social Cognitive Theory, and is represented graphically in Figure 1. This model is based on Bandura's (1986) explanation of how these variables interact bi-directionally in a triadic reciprocal relationship.

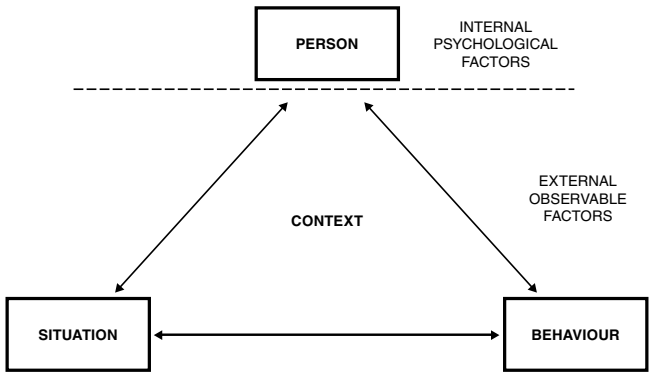

Figure 1: A Model of Reciprocal Determinism

Psychological variables include the values, beliefs, and attitudes that people have about safety-related issues, as well as their knowledge, motives, and personalities. Behavioral variables are the competencies of individuals and patterns of action and behaviors. Situational variables include the organizational structure, processes and systems, as well as external variables such as the complexity, context and nature of work performed, as well as the equipment, tools and machines used in task performance.

In this model, safety performance is the dependant variable and the psychological, behavioral and situational factors are the independent variables. It is important to understand the dynamics of the relationship between safety culture and organizational performance and how modifying organizational culture affects performance. Organizational culture influences the development of a safety culture within an organization. Safety culture is influenced by psychological, behavioral, and situational variables. Safety culture affects safety performance and safety performance has a significant impact on overall organizational performance.

In the fire service, for example, if firefighters become casualties because of unsafe acts, then resources are directed toward the rescue and care of these firefighters. If resources are being directed toward the rescue of firefighters, they must either be drawn away from operations directed at rescuing civilians, or become unavailable for that purpose if they should be needed. This can have a significant impact on organizational performance. If resources are drawn away from the rescue of civilian casualties in order to rescue firefighters who have become casualties as a result of unsafe acts, then it would be anticipated that civilian injury and death rates would be higher than if these firefighters had not become casualties.

It is interesting to point out that the US has not only a high firefighter casualty rate, but also a high civilian casualty rate; whereas other industrialized nations that have a low firefighter casualty rate also have a low civilian casualty rate. As firefighters change their assumptions, values, beliefs and practices with regard to safety by establishing a strong safety culture, then fewer firefighters would be expected to become casualties due to unsafe acts. This allows more resources to be used for or to be available for the rescue of civilian casualties, thereby improving the performance of the fire service by reducing civilian casualty rates.

Culture, Identity and Image

Modifying or changing the safety culture within an organization involves changes in the psychological and behavioral aspects of the members of the organization. In addition, because organizational culture also conveys a sense of identity (Wiegmann, 2004), a change in culture also involves a change in the image of the organization and its members. Therefore, it is important to understand the relationship between culture, identity, and image and how these factors influence the development of a safety culture.

Organizational culture is viewed by some researchers as one of the two essential components of organizational identity. Theoretical development of the construct of organizational identity postulates that culture and image are the two components of organizational identity (Hatch & Schultz, 2002). Within this framework, culture is the internal element and image is the external element of identity. This has been described as the organizational identity dynamics model, and is represented in Figure 2.

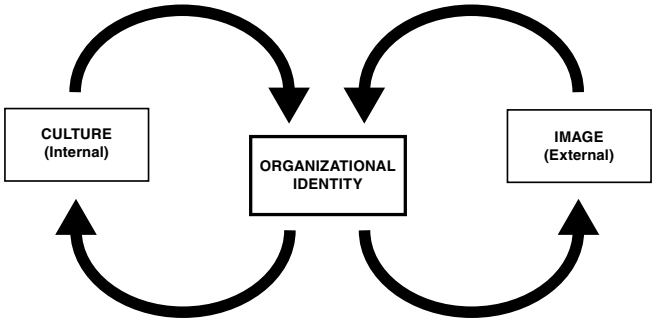

Figure 2: Organizational Identity Dynamics Model

Within this model, identity in organizations involves the interaction of both the internal and the external definition of the organization. Organizational culture has been previously defined as the assumptions, values, beliefs and norms that provide meaning to members of an organization, which includes the establishment of an internal self-definition. Organizational image is the set of beliefs about the organization held by those who are not part of the organization but who are relevant stakeholders or constituents. These form the external definition of the organization. For members of an organization, culture provides a sense of who we are, and image provides a sense of how others see us (Hatch & Schultz, 2002). These two approaches provide a comprehensive perspective on organizational identity.

Dysfunctional Aspects of Identity

A healthy identity results from the capacity of an organization to integrate and balance the various aspects of culture and image. A dysfunctional identity can result from a process that involves two stages. First, a disassociation occurs between the internal and external definition of the organization. Secondly, the concept of identity becomes dominated by either the internal or external definition of identity to the exclusion of the other. When the identity of an organization is constructed solely on the basis if its culture, it is vulnerable to a dysfunctional condition that has been called organizational narcissism. When its identity is constructed exclusively by the organization's image, then it is vulnerable to the condition of organizational hyper-adaptation (Hatch & Schultz, 2002).

Organizational narcissism may be an important factor in explaining why the US fire service has not adapted more effective safety management systems. Iden-

tity plays a critical role in how organizations adapt to change (Dutton, 1991). Identity influences how issues such as safety are interpreted and how individuals and organizations respond to issues. If an organization or a profession suffers from a condition of narcissism, then this is likely to have a dramatic effect on whether or not changes in safety management systems will be developed and sustained. Therefore, it is important to understand the effect of organizational narcissism and how identity influences the organizational adaptation process.

When a state of narcissism is present in an organization, the members of the organization make inferences about their identity on the basis of how they express themselves to others. This means that the identity of the organization is really just a reflection of their own self-understanding which is being mistaken for the expressions of others. The process of forming and sustaining organizational identity becomes internally focused and self-contained. The needs and interests of external stakeholders and constituents are ignored, and the organization becomes unable and unwilling to respond to pressures for change from those who are external to the organization. In essence, narcissism becomes an effort to maintain self-esteem that has been taken to extremes (Hatch & Schultz, 2002).

Efforts to maintain self-esteem and organizational identity result in the use of defense mechanisms that are intended to maintain those features of the organization that are viewed by members as the central, enduring and distinctive characteristics of the organization's identity. Individual self-esteem and organizational identity are linked when an individual's self-esteem is based in part on the identity of the organization of which that individual is a part. The desire to protect individual and collective self-esteem can be a powerful ego defense mechanism that can limit the ability and willingness of organizations to search for new information or interpret and evaluate information in ways that may not be consistent with the currently held concepts of individual or collective identity (Brown & Starkey, 2000). Such defense mechanisms reduce the capacity for organizational learning and change.

Specific behaviors have been associated with the construct of organizational narcissism. These include denial, rationalization, attributional egotism, a sense of entitlement, and self-aggrandizement (Brown, 1997). Denial is used as a way of coping with conflict, anxiety and distress that would otherwise be extremely difficult if not impossible to deal with. Research has suggested that people who engage in denial do so in order to conceal disagreeable truths from themselves and others as an unconscious attempt to maintain individual and collective self-esteem (Straw et al., 1983). Rationalization involves the development of justifications for actions that are consistent with the current self-concept. This may include what has been called retrospective sense making, which occurs when individuals provide explanations of their past actions in order to preserve their self esteem. For example, a fire chief may provide an explanation of why several firefighters died in the line of duty, and then state that if they were in the same situation, they would make the same decisions and take the same actions.

Rationalization may sometimes be used along with the concept of attributional egotism, which occurs when people provide self-serving explanations for incidents. These explanations may be self-serving in that unfavorable outcomes are attributed to external factors, while favorable outcomes are attributed to the efforts of the members of the organization. If attributional egotism is present, then self-aggrandizement may not be far behind. This refers to the propensity for people to overstate their accomplishments. Self-aggrandizement can also be accompanied by self-absorption, claims to uniqueness, and feelings of invulnerability (APA, 1986). An example of a sense of entitlement would be apparent in demands for additional resources or compensation by members of the fire department based on the level of risk inherent in fire fighting and the potential for injury, without any other justification.

The Influence of Identify on Organizational Adaptation

In a study of organizational adaptation to change, Dutton (1991) provides strong evidence that organizational identity has a significant influence on how issues are interpreted by members of an organization and on what actions are considered to be a legitimate response. He argues that the process of adaptation begins with the recognition of a current development, event or trend that has some consequence for the organization. In other words, adaptation begins with the recognition of a significant issue, such as the issue of safety. Organizational identity lays the foundation for how an issue is interpreted by members of the organization, the direction and level of emotional response to an issue, and the pattern of actions that are taken in response to an issue. The proposition made in the study conducted by Dutton is that organizational identity influences how organizations adapt to issues by affecting the interpretations, emotions, and actions associated with the issue.

Issue interpretation is the initial cognitive response to the issue. The interpretation of issues involves making determinations on the importance of the issue and whether the issue represents a threat to individual or collective identity. These initial interpretations begin to develop the meaning of the issue and to limit and shape the criteria for a legitimate solution by limiting what is conceived of as a legitimate interpretation. The importance of an issue also sets the stage for the level of emotional response to the issue: the higher the importance, the higher the potential emotional response.

Issue-related emotions are the affective response to the issue. The emotional response of members of an organization is expected to be negative when the issue and related actions are interpreted as inconsistent with the identity of the organization and its members. When an issue and related actions are interpreted as

consistent with the organization's identity, the emotional response would be expected to be positive. As a fire service example, in some organizations, any attempt to change the mission of the department from emergency response to injury and accident prevention would be met with a very strong negative response because this issue would be interpreted as very important and highly inconsistent with the current identity of the organization and its members.

Issue-related actions represent the behavioral response to an issue. Identity serves to restrict the use of information, to limit the criteria that are used to form an acceptable and legitimate solution, and to control what measures are used to assess effective performance. It is at this point where identity is most closely associated with organizational traditions. The traditions of the organization or the profession of which it is a part establish preconceived ideas about what should be done to deal with issues, and what constitutes appropriate action. For example, if denial, rationalization, self aggrandizement, attributional egotism, and an attitude of entitlement have been successful in defending individual and collective identity in the past, these behaviors would be expected to continue to be used to defend against any future challenge to organizational identity.

The research conducted by Dutton (1991) supports the assertion of other previous research that organizational identity has a strong influence on how organizations adapt to change through the influence that identity has on how issues are interpreted. The constructs of individual and organizational identity are used as reference points to determine if the actions taken in relation to an issue are consistent with individual and collective identity or not. The determination of consistency or inconsistency precedes the motivation to support or resist an issue. If an issue is consistent with identity, it is likely to be supported. If an issue is inconsistent with identity, it is likely to be resisted.

Organizational Identification

Discussion thus far has defined and described the elements of organizational identity, which includes the internal attributes of culture and the external attributes of image. The concepts of organizational adaptation have also been discussed. But organizations are made up of people, and it is important to understand how the concept of identity affects people in order to modify the identity of the fire service to one that is more supportive of safety management systems. While organizational identity relates to the construction of the internal and external attributes of organizations, the concept of organizational identification relates the identity of the organization to the self-concept of the individuals that are a part of the organization.

Individuals are connected to the organization of which they are a part when their self-concept contains the same attributes that are ascribed to the organization. This connection has been defined as organizational identification (Dutton et. al., 1994). As individuals integrate more of an organization's characteristics and attributes into their self-concepts, they become increasingly attached to the organization. At the same time, the level of congruence between the practices, values, beliefs and norms of the organization and the individual increases. The strength of the individuals' identification with the organization increases with the level of fit or congruence between the identity of the organization and the self-concept of the individual. What this means in practical terms is that if an individual finds the culture and image of an organization to be consistent with the way they define themselves, they are likely to have a high affinity for that organization.

Three principles have been established in other research to define the construct of self-definition. These are self-continuity, self-distinctiveness, and self-enhancement (Dutton et. al., 1994). The concept of self-continuity recognized the desire for people to be able to maintain a consistent self-concept over time and in different contexts. When an organization provides the opportunity for self-expression and is relevant to their self-concept, that organization will be more attractive than others that do not provide the same opportunity for self-fulfillment. The distinctiveness of on organization can also accentuate the distinctiveness of the individuals associated with that organization because the individual shares in the distinctiveness of the values and practices of the organization. When individuals are a part of on organization that has a positive or attractive organizational identity, their personal self-esteem is increased because these individuals see themselves as having the same positive qualities and attributes as the organization of which they are a part. An important point to make about the concept of self-definition is that the relationship between organizational identity and self-concept is something that people experience on a very personal level. This means that any increase or decrease in the attractiveness of organizational identity has the potential to have a significant impact on the cognitive and affective perception of self within the individual.

Another important aspect of organizational identification is the positive social identity that individuals gain from affiliation with organizations that have a positive identity and a high level of social value, like the fire service. Empirical studies have demonstrated that affiliation with such organizations provides individuals with a number of personal social benefits. These include the creation of self-gratifying social opportunities, heightened social prestige, the facilitation of social interactions, and the creation of social credits (Dutton et. al., 1994).

A Model of Organizational Identity, Self-Definition, and Adaptive Response

The relationship between organizational identity, self-definition and the adaptive response to issues is represented in Figure 3. This model assumes an initial

steady state of equilibrium where the organization's identity has a high level of congruence with the self-definition of the members of the organization. No adaptive response is necessary when a high level of fit exists between the attributes of the organization and those of the individual members. When a significant issue is recognized, such as the level of safety within the organization, this initiates the adaptive cycle. Significant issues are defined as those that have the potential to result in a significant change in either the culture or image of the organization.

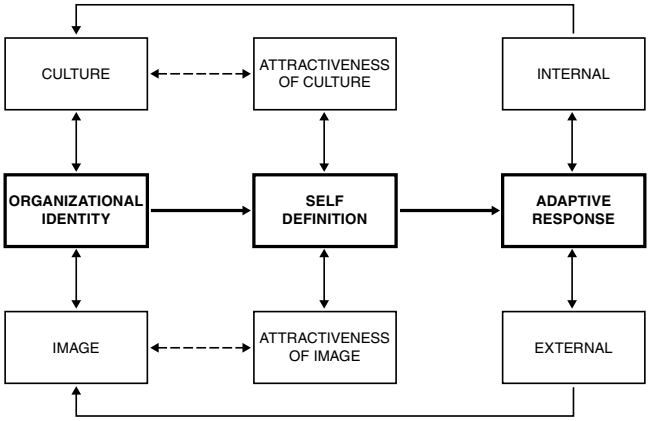

Figure 3: Organizational Identity, Self Definition, and Adaptive Response

In this process, the issue is interpreted, an emotional response is formed, and adaptive actions are taken. The level of emotional response will be on the same scale as the level of importance of the issue or the potential threat to identity. If an issue is interpreted to have the potential to increase the level of congruence or fit between the organizations identity and the self definition of its members, then the adaptive response will be supportive. If the issue is interpreted to have the potential to decrease the level of congruence or fit between the organization's identity and the self-definition of its members, then the members will either change their self-definition and support the change in identity of the organization, or resist the change in identity of the organization in order to preserve their own self-definition.

A hypothetical example of how this model works may be helpful. Take the issue of safety in the fire service. The identity of the fire service could be described as one that includes a culture and image based on the values, beliefs, and practices resulting from the idea that members are willing to risk their lives to save others. Because firefighters are willing to take this kind of risk, they receive a very positive social identity as part of the image that the public carries about firefighters and the profession. In fact, it would not be irrational to propose that the level of risk firefighters may potentially take has become the measure of value for the fire service. Individuals join the fire service because the internal cultural values of the organization are consistent with their self-definition.

The positive social identity that results from the image of the fire service also provides personally satisfying rewards and consequences in terms of social opportunities, social prestige, social interactions, and social credits. For example, when a firefighter tells people in a social setting about what they do, they are immediately identified as a person who has the same bravery and courage they associate with the fire service, which provides a higher level of social prestige than other occupations. An example of social credits occurs when a firefighter is pulled over by a police officer for speeding, and is let go without a ticket because of the union or departmental sticker in the back left corner of the rear window. The police officer gives the firefighter a break because of the bravery and courage that firefighters may be called upon to demonstrate in the course of their work. The point is that the image and the culture of the fire service are highly attractive to the individual because they are consistent with the way the individual defines him or herself.

What happens, however, when an issue arises that may change the culture and image of the fire service? Part of the identity of the fire service is based on the bravery and courage of firefighters, which is demonstrated in part by the number of firefighters killed and injured in the line of duty. Fire fighting is perceived as a dangerous occupation, which is one of the reasons for the high level of identification members have with the service, and for the high level of positive social identity the fire service has in the eyes of the public. Safety has the potential to change the culture and image of the fire service by changing the criteria used to establish the social value of what the fire service does for the public. How would firefighters think of themselves and the value they provide to their communities if not one firefighter died in the line of duty? What would the public think of firefighters and the profession if not one firefighter died in the line of duty? If fire fighting is no longer perceived to be a dangerous occupation, what criteria will be used to demonstrate the value of fire service organizations and their members? If bravery and courage, risk and danger, are no longer used as the measure of value, what will happen to the social identity of firefighters? Will they have the same level of social opportunities, social prestige, and social credits?

The issue of safety has the potential to change the way the fire service as a profession thinks of itself and to change the way others think of the fire service. Safety has the potential to shatter the self-definition of the members of fire service organizations by changing how they see themselves and how they measure their value and worth in society. Increasing the level of safety also has the potential to decrease the level of positive social identity associated with being a member of the fire service. Bravery, courage, risk and danger are part of the foundation of the culture and image of the fire service. The practices, values, beliefs and assumptions of the value and worth of the fire service are based largely on these concepts.

If the fire service was to change to a safety-based identity, what might be expected in terms of the adaptive response of fire service organizations and their members? Because the issue of safety has the potential to change the culture and image of the fire service, it is clearly a significant issue. If efforts are made to change the identity of the fire service to an identity based on safety rather than risk, these efforts will be interpreted, emotional responses will be formed, and actions will be taken in response. In some if not most instances, these changes will be interpreted as inconsistent with the current identity of the organization, and as inconsistent with the self-definition of its members. A safety culture has the potential to change many of the practices, values, beliefs and underlying assumptions upon which the organization is currently formed. In addition, a safety culture has the potential to decrease the social identity associated with the affiliation of individuals with fire service organizations. For members of the fire service, their level of social prestige will decrease, their social opportunities will be more limited, and they may not receive the same level of social credits they previously enjoyed. Given the potential negative effects on organizational identity resulting from a change in organizational culture from a risk-based culture to a safety-based culture, it might be expected that the adaptive response would be strongly resistive to such a change.

Resistance to a change in organizational identity is likely to result in defensive behaviors such as denial, rationalization, self-aggrandizement, and attributional egotism. These behaviors may be used internally in an attempt to resist or minimize a change in culture, or externally to maintain the image and positive social identity of the organization. With regard to this hypothetical example, denial might take the form of avoiding personal responsibility and accountability for incidents that result in firefighter deaths or injuries. Biased or predetermined explanations are provided that deny, omit or conceal information that might tarnish the image of the organization or the profession. These types of explanations are intended to limit personal and organizational responsibility for negative or controversial outcomes.

When an incident results in a firefighter casualty, organizational representatives are usually quick to develop some type of rationalization for what happened. The purpose of this rationalization is to justify the motives, actions and consequences surrounding the incident. These are sometimes efforts to rationalize actions through retrospective sense-making. The rationalization may be based on nothing more that a best guess of what the motives and actions were that resulted in the casualty. However, pressure for some type of rational explanation for what has happened puts pressure on the organization to provide some kind of explanation. What is typically provided in these circumstances is an explanation or rationalization that attempts to sustain organizational self-esteem (Brown, 1997).

This example is intended to provoke a different way of thinking about the problem of safety in the fire service. The relationship between organizational identity and self-definition clearly has benefits, but it is the problems associated with this relationship that are the most important aspect of the relationship to understand from a safety perspective. It is the problems associated with organizational identity that may be getting in the way of improving the safety performance of the fire service

Developing a Safety Culture in the Fire Service

The argument advanced here is that the first requirement for the successful development of a safety culture is to provide an understanding of organizational identity as defined by culture and image. The second requirement is to understand the adaptive process involved in dealing with significant issues. The third requirement is to recognize the defensive behaviors that result from a resistive response to a significant issue. The successful achievement of these requirements is much more likely when attempted within a context of psychological safety and trust so that these issues can be discussed openly within the organization. If these issues can be discussed openly, and the underlying assumptions of the currently held values and beliefs explored fully, it will be possible to introduce the elements of a safety culture within the organization and to begin working toward making these elements a part of the organization's identity. Once these elements have been accepted as part of the culture and image of the organization, the next requirement is to be vigilant in sustaining an attitude toward safety as a never-ending process. Safety is not a final destination, but a constant process of inquiry, analysis, and change.

Changing the culture of any organization is a transformation process that requires a comprehensive understanding of the underlying issues involved with organizational identity. Much of this paper has been directed at providing a preliminary overview of the issues involved in a change of organizational identity from a risk based identity to a safety-based identity. A transformational change of this magnitude involves not only individual fire service organizations, but the profession as a whole. Individual departments attempting to make this transition will need all the support they can get from other organizations and institutions involved in fire protection. If the fire service is to be successful in reducing firefighter casualties, there must be a determined and sustained effort by those individuals and organizations that care about the fire service to change the way we think about who we are, how we measure the value of what we do for the communities we protect, and how our constituents think of the fire service. A transformation change like this requires a deep understanding of the issues and problems that surround a change in the identity of the fire service.

Development of a safety culture within the fire service will require a change in many of the behaviors, practices, values, beliefs and underlying assumptions that make up the current culture of many fire service orga-

nizations. Previous efforts over the last few decades to improve the level of safety within the fire service have been largely unsuccessful, as represented by the data on firefighter death rates. One of the reasons for the lack of success in improving the safety performance of the fire service in the US may be the due to a lack of understanding about how changing the safety performance of the fire service affects the culture and image of the fire service. People may be reluctant to attempt to raise these issues because they are difficult issues to talk about, and dealing with some sort of technological fix is much easier that dealing with people.

Dealing with changes in the underlying assumptions upon which the current thinking and practices regarding safety performance are based is a difficult process because it involves discussion and disagreement about deeply held values and beliefs. It is a process that is sure to generate high levels of conflict. However, with a solid understanding of how change influences the identity of organizations, in terms of internal culture and external image, people will at least have a point from which to begin discussions about how to make significant and lasting improvements in safety performance. The purpose in developing a safe and open discussion of underlying assumption, values, beliefs and practices associated with the issue of safety is to open up the opportunity for successful identity change.

It is also important to have an understanding of the adaptive process. The process presented earlier involves the recognition of a significant issue that must be dealt with by members of the organization. The issue of interest in this paper has been that of firefighter safety. This issue will be interpreted by members of the fire service through the filter of organizational culture and image. Members will develop an emotional response to their interpretation of the issue, which will then form their adaptive response in terms of a supportive or resistive approach to the issue.

A resistive response to the issue of safety will include a number of different defensive behaviors. These have been previously identified as denial, rationalization, attributional egotism, a sense of entitlement, and self-aggrandizement (Brown, 1997). Even after creating a safe environment for discussions about how identity might be changed by the initiation of a safety culture, some level of defensive behavior can be anticipated. These behaviors need to be recognized so that the underlying assumptions, values and beliefs driving these defensive behaviors can be dealt with openly and constructively.

Organizations will be prepared for change when the members of the organization understand the attributes of organizational identity and the process of adaptive response, and can recognize the defensive behaviors used to resist change. The process of change then shifts to the introduction of the elements of a safety culture as an attribute of the identity of the organization. Every though fire departments are all part of same profession, each is slightly different in terms of the attributes of their culture and image. As a result, the application of the elements of a safety culture within each organization may also be slightly different as well. These differences are minor compared to the importance of being able to plan for and implement the appropriate elements of a safety culture within the specific context of each organizations culture and image. These elements include organizational commitment, management involvement, employee empowerment, reward systems, and reporting systems. Each of these is described and explained in more detail in the literature on the development of a safety culture (Wiegmann et al., 2004).

Conclusion

The development of a safety culture in the US fire service will be a difficult transformation. These fire service organizations are controlled by local government, making regional or national change more difficult to accomplish. National-level associations and institutions appear to have little influence on changing the culture of the profession. In addition, some may have even less desire to promote and support the change to a safety culture, either because it is too radical a change from the current identity of the fire service, or because it is such a daunting task. This is clearly a high-risk operation.

Those who choose to embark on the effort to change the identity of their organization, and to begin to change the identity of the fire service, will face a highly emotional and defensive response. They will have to rely on the same bravery and courage that they have demonstrated on the fireground in order to survive the challenges involved in a transformational change of identity in the fire service. But the opportunity for making a significant improvement in the safety performance of the fire service is a tremendous reward and well worth the effort.

Safety is not about how many firefighters are riding on the fire engine, it is about the values, beliefs and assumptions that firefighter make about what it means to be riding on the fire engine. An optimal safety culture maximizes the effectiveness of available resources within reasonable and acceptable limits of risk. The value and worth of the fire service should not be measured by the level of risk and danger to firefighters, but other measures of value and performance are lacking for the fire service.

As the culture of the fire service shifts from an identity based on risk to an identity based on safety, it may be imperative to develop valid and reliable measures of performance to demonstrate the value and worth that the fire service provides for our communities. Although this is separate issue, just like the issue of safety, the development of more comprehensive measures of performance has the potential to challenge the current identity of the fire service.

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Applying Good Health and Safety Management at Operational Incidents: A Dilemma?

Abstract

This article asks whether the immediate needs and pressures of operational incidents are in conflict with the implementation of good health and safety management techniques for the fire and rescue service. Anecdotal views from some practitioners show that they can regard "health and safety" as preventing them from doing the job of safeguarding the communities they serve. On the other hand, good health and safety management at incidents can be seen as just one part of managing incidents in a professional and competent way. The article provides an outline of how the legal duties on UK Fire & Rescue Authorities to look after the health, safety and welfare of their employees are applied in practice to the work of the fire & rescue service. The argument advanced is that good health and safety management techniques can and should be applied to all aspects of fire & rescue service work, while fully taking into account the specific circumstances facing firefighters at operational incidents. The key to implementing good health and safety standards at operational incidents is achieving and maintaining competency at all levels. If fire and rescue staff are to be competent, they need to practise in as realistic conditions as possible, even though this will give rise to increased risk during the realistic training.

Background

All emergency service workers face increased risks to their health and safety as part of their normal work and generally have a higher-than-average (for all occupations) incidence of injury and ill-health. Incidence figures (accidents per 100,000 employees) in the UK for 2001/02 are presented in Table 1 for purposes of comparison (HSE, 2003a). It should be noted that the employment figures for the fire service include retained firefighters[1] and support staff, but exclude volunteer firefighters. Employment totals for the police service include Special Constables.[2]

not possible to remove the firefighters from the hazard, so other methods have to be employed to control the risks to an acceptable level. Personal protective equipment (PPE), which in most cases is used when a range of other control measures have already been implemented, is often the front-line defence for the fire and rescue service.

The key question is always what an acceptable level of risk is. The objective of the firefighters' activity has to be brought into the equation when deciding on acceptability. The range of scenarios goes from a knowledge

Table 1: Incidence Figures of Accidents per 100,000 employees in the UK for 2001/02, By Employment Sector

Employment Sector	Major Injury (for example, fractures, amputations or being admitted to hospital for more 24 hours)	Over 3-day absence from work
Manufacturing	192	990
Construction	378	835
Police	241	1,263
Fire Service	212	2,085

There are other occupations that have a higher incidence of injury or ill-health but there are a number of factors that make a significant difference to the way in which these risks can be responded to. In most occupations, if it is not possible to eliminate hazards, control measures are put in place to remove employees from the risks generated by the hazards. However, firefighters have to deliberately go into operational situations which present a variable and higher level of risk from uncertain hazards. In these circumstances it is simply that there are lives to be saved, without undue risk, through to a knowledge that no other person is at risk, but the risks to firefighters are high. The factors can be summarised as shown in Figure 1.

This can be put in terms of a cost-benefit type analysis, where the risks to firefighters from taking a particular line of action are balanced against the benefits from taking the action. There are high societal benefits from saving life, but little or no benefits from taking risks to "save" an already damaged building.

It is not, however, an easy matter to decide how to balance the benefits and risks, especially as the risks are not faced by those who get the benefits. Fire Authorities need to plan, equip and train their firefighters to take immediate decisions and action on the basis of usually inadequate information about a changing situation. There is a high level of public expectation that firefighters both can and will respond to almost any demand put upon them. At incidents, this creates additional pressures on firefighters to put themselves at risk, without necessarily considering the consequences for their own health and safety. If appropriate prior planning and preparation has not been done this leaves firefighters in a very vulnerable position.

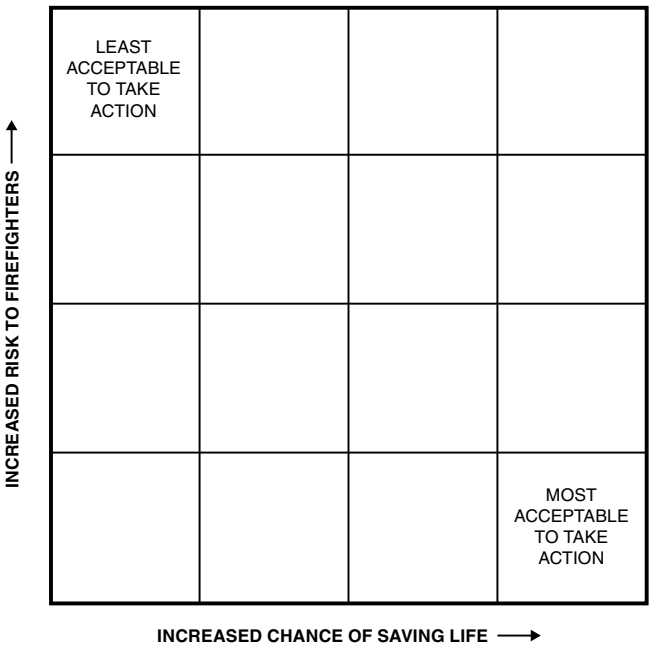

Figure 1: Risk Analysis and Firefighter Action

The Dilemma

There are two dilemmas that we should look at. First, there is this dilemma of a perceived conflict between applying good health and safety management techniques at incidents and responding to save life and protect property. The second dilemma is a cultural one that applies in the UK and may well be recognised in the U.S. situation. The core business of a fire and rescue service is to save life. Therefore, applying health and safety control measures is already intrinsic to the service. At times, this leads to an over-prescriptive and even bureaucratic approach, with detailed assessments of almost all conceivable situations and equipment. However, what can be an over-cautious approach is not applied in the heat of the moment, when instant responses take over without adequate consideration of the way the incident should best be handled.

The key dilemma, however, is the perceived conflict between the demands of an operational incident and the application of good health and safety management practices. Generally, good health and safety management practices require a high level of prior planning with hazards identified and analysed in detail and stringent control measures applied for high-risk activities. The normal hierarchy of control measures has elimination or prevention as the first steps, with measures such as personal protective equipment or procedures as a last resort (for example, see HSE 2005 and HSE 2006). In order to respond effectively to incidents the preferred measures may not be possible, leading to a greater reliance on PPE and information as the only control measures.

Fire and rescue services should not, of course, neglect the possibility of risk avoidance where this is possible; for example, by making more use of defensive rather than offensive fire fighting techniques where there are no lives to be saved. The nature of an operational incident does not lend itself to detailed prior planning and these differences are explored in greater depth later in this paper.

The culture of most fire and rescue services has often been a "can do," almost aggressive approach, irrespective of risk. Proponents of such a culture will inevitably see the caveats imposed by health and safety practitioners as restricting their ability to carry out their job.

In the UK, legislation requires employers to ensure, so far as is reasonably practicable, the health and safety at work of their employees (HSWA 1974). The qualification "so far as is reasonably practicable" is key. It ensures employers are not faced with an impossibly high absolute duty of care, but do have to carry out a prior assessment of the hazards and risks and then ensure appropriate control measures are put in place to deal with the risks. In general terms, a balance has to be struck between the level of risk and the cost of implementing control measures. Only if the "cost," which may be more than just financial, is disproportionate to the risk do control measures not need to be taken. It is intrinsic to the duty that the control measures have to be appropriate to the context. Thus, measures that will be required in one employment sector may well not be appropriate in the case of the emergency services. This can best be understood in the administrative procedures used by the UK Health and Safety Executive's inspectors when considering what, if any, enforcement action is appropriate (HSE, 2002a). They consider how far the duty-holder was from the appropriate "benchmark" standard. The "benchmark" standard for an emergency service operational response will be very different from that in, for example, a factory or office environment.

The legal duty of "so far as is reasonably practicable" has been explored in a number of legal cases in the UK, the principal one being *Edwards v National Coal Board* (1949). There have been few legal cases in the UK that have explicitly explored this concept as far as emergency services operational responses are concerned, although the case of *Watts v Herts County*

Council (1954) may give an indication of how the courts would react. In this case a firefighter had a claim for compensation following an injury rejected on the grounds that society expected emergency service workers to put themselves at risk in the course of their work. The UK courts are likely to take account of the benefit to society of having firefighters put themselves at risk in order to save life when balancing the risks and benefits of a particular operational response. What is certain is that employers do need to have good health and safety management systems in place in order to demonstrate that they have carried out the computation required by "so far as is reasonably practicable" and implemented whatever control measures are appropriate in their circumstances.

Views on the tolerability of risk vary greatly, often depending critically on the perceived benefits to the individual of accepting the risk. This can be seen, for example, in most people driving cars, notwithstanding the proven risks, as an acceptable trade-off for the convenience of having a car (often regarded as a necessity rather than a luxury). Attitudes to tolerability of risk have been explored extensively in work carried out for HSE (HSE 1999 and 2001).

Health and Safety Management

Guidance is available from the UK Health and Safety Executive on good health and safety management (HSE 1997). The structure is used as a benchmark by HSE's inspectors when assessing organisation's health and safety performance. In practice the structure is widely used in many contexts, beyond "pure" health and safety management, as an accepted framework for achieving sensible management practice. The structure, in outline, has the following components:

- Policies: effective health and safety policies set a clear direction for the organisation to follow;
- Organising: an effective management structure and arrangements are in place for delivering the policy;
- Planning: there is a planned and systematic approach to implementing the health and safety policy through an effective health and safety management system;
- Measuring performance: performance is measured against agreed standards to reveal when and where improvement is needed;
- Auditing and reviewing performance: the organisation learns from all relevant experience and applies the lessons.

A key part is recognising that health and safety is one aspect of providing an effective and efficient response, based on overall sound management practices. The philosophy behind much of HSE's work is to get across the message that good health and safety performance is an integral part of achieving any organisation's core goals, whether that be delivering a service to the community or making a profit.

As can be seen, these principles of good health and safety management can be applied to any circumstances, including an operational incident. Every employment sector does, of course, have its own unique characteristics so the benchmark standards will vary from sector to sector. This is very obvious for the emergency services personnel, who face issues that are not relevant to most employment sectors. If the issue can be summed up in one sentence, it is that while the general rule is to go away from hazards, the emergency services have to go into hazardous situations. There are a number of factors that apply to the fire and rescue service that set its unique character:

- The fire and rescue service does not have complete control or any choice over where they have to work. The incident ground cannot be prepared for operations and, intrinsically, there is an emergency situation. The hazards that are present will either have been created by the emergency or normal procedures no longer provide adequate control.
- Especially during the initial phases of an incident, there is unlikely to be adequate information about the nature and extent of the hazards that are present. Considerable reliance has to be placed on expertise and experience, particularly of the officers-in-charge, for appropriate decisions to be made. How this expertise and experience is gained will be returned to later in the paper. The reality is, however, that decisions have to be made based on whatever information is to hand at the time.
- When there are lives to be saved then an immediate response is essential. Decisions have to be made without being able to take time to consider all the circumstances, with detailed analysis of all possible options. Again, expertise and experience are required to make sensible decisions about whether lives can realistically be saved or whether the operation is one of body recovery or saving buildings. Whereas there are clear benefits to be gained in firefighters facing higher risks, in a controlled manner, when there are lives to be saved, these risks are far less likely to be justifiable in other circumstances.
- In most employment sectors the range of hazards are predictable and do not change significantly with time. The same is not true of an operational incident dealt with by the fire and rescue service. Incidents develop in unpredictable ways which command and control procedures have to accommodate in order to match the operational response to the way in which the incident evolves.

Firefighters require training in carrying out risk assessment as a dynamic process throughout an operational incident.

- The traditional role of the fire & rescue service, to fight fires, remains core business. While it has long been the case that fire & rescue services have carried out a range of other activities, the service has not necessarily been well-equipped or trained for these other activities. In the UK, the legislative framework is now catching up with the wide range of activities carried out with fire authorities having an explicit responsibility to respond to road traffic accidents and, from next year certain major incidents such as large scale flooding and urban search and rescue following, for example, terrorist incidents. While the fire & rescue service is generally very willing to respond to these types of incidents, they do present a challenge to ensure equipment provision, training and command and control structures are adequate to ensure both an effective response and safe operating procedures.

Given all the background, is there really a dilemma between providing an effective response at operational incidents and applying good health and safety management practices? Certainly, this view is expressed by some people within the service and also the public seem to expect firefighters to put themselves at risk in order to save life (and even to protect property). The expectation is not, of course, unqualified. Unpublished work carried out for the Health and Safety Executive confirmed that there is a high expectation among the public, firefighters and HSE inspectors that the firefighters' role did present increased risk of injury or ill-health. Interestingly, the public's view was based on an assumption that firefighters were always equipped, trained and competent to deal with any eventuality. When presented with the possibility that this was not necessarily the case the public's views on regulatory intervention did change somewhat.

There is evidence that good health and safety management has wider benefits than just a reduction in injury and ill-health. The Health and Safety Executive (HSE, 2004) has published a series of case studies across a range of employment sectors and types of intervention showing the benefits to the organisation concerned, whether in reduced staff absence or more direct financial returns. This evidence obviously supports such programmes as sickness absence management but may not seem so relevant to operational incidents. However, good management of operational incidents, with all the challenges involved, is even more important than for non-operational work if an effective and efficient outcome is to be achieved. High standards of health and safety should be just one aspect of this good incident management. This does not mean applying controls that are designed for and only appropriate to a static situation or requiring excessive detailed assessments and bureaucratic record keeping. The culture of the fire and rescue service may need to shift to provide the right balance between over-prescriptive, inflexible rules and not responding adequately to the risks undoubtedly present at operational incidents.

Competence

Research carried out for HSE in the chemical industry (HSE, 2003b) showed that employers should not make untested assumptions about the competence of employees to deal with emergency situations. The research looked at a number of major plant failures in the chemical industry and found that fully trained operators often did not properly understand the processes they were running or the consequences of their actions when failures occurred. The results were that failures that could and should have been controlled led to uncontrolled plant failures and content releases. The research illustrated that provision of training and achieving adequate competence are not the same. The importance of adequate training should not be underestimated, but appropriate means are needed to assess the competence of employees to deal with real-life situations. *Competence* is the ability to undertake responsibilities and to perform activities to a recognised standard on a regular basis. Competence is a combination of practical and theoretical skills, experience and knowledge. There are a number of aspects to achieving a sound competency-based system (see HSE, 2002b):

- There is a need to know the hazards that could arise in every task (including normal operation, maintenance and emergency tasks). This is likely to be more generic in nature for the fire and rescue service but is a vital first step to deciding on the skills etc., that are needed. The "normal operation" for the fire & rescue service is an emergency incident, but "emergency tasks" could include, for example, thinking through the consequences of there being firefighter casualties.
- Have a good selection process to identify suitable employees or contractors for those tasks. The fire and rescue service needs to have clarity about the recruitment criteria which are required for the role of firefighter. This need for clarity of criteria should also extend to the selection of staff for promotion to all levels of the service.
- Know the exact type of person to assign to each task. This issue is partially out of a fire and rescue service's control as tasks have to be done with whoever is available, but planning assumptions and consequential training do need to look at the tasks and who is needed to fulfil them safely and effectively.
- Have enough people to always be able to put the right person onto a particular job. Concerns identified in the previous bullet also apply to this point. However, planning should consider the range

of tasks which are foreseeable and the staffing required to deal with them.

- Identify any gaps in a person's skill or knowledge or experience (competence).
- Know the best way of providing the skills and knowledge that people need (i.e., training--including on the job).
- Have access to the best training resources (training facilities, trainers and equipment).
- Make it easy for people to get the training they need. There is a question about whether the fire & rescue service has sufficient time to provide adequate training or whether it is a matter of how the time is planned. The issue is particularly acute for firefighters who are not full-time.
- Always use actual work instructions/procedures in training. This fits in well with ensuring that realistic training is a core activity (see below).
- Continually improve managers' as well as staff competence. In the fire and rescue service, Incident Command is a critical element in delivering a safe and effective service.
- Never make a person do a job they are not competent to do. This issue could have major implications for the fire and rescue service as it may conflict with a "can-do" culture. It is essential that the fire and rescue service must remain flexible and responsive to the demands on it, while embedding appropriate health and safety control measures in systems and procedures.
- Assess whether training has worked.
- Retrain people if they need it.
- Keep good records so that we know what training/experience each person has had and what they need next.
- Change the selection, training and assessment system if it is not working.

Realistic Training

The nature of fire and rescue service work means that there is likely to be insufficient "on the job" activity to achieve and then maintain competency. While the UK fire and rescue service still attends a large number of fires, there is a welcome reduction in the number of large, complex incidents. As a result, both front-line crews and incident commanders may not have recent, relevant experience of the issues they can face. Realistic training seeks to fill this potential gap by replicating operational scenarios in a controlled training environment. The question has been raised as to whether it is justified to put firefighters at enhanced risk during realistic training; an activity that does not, of itself, directly result in the saving of life. The Health and Safety Executive (HSE, 1984) has long taken the view that realistic, but controlled, training is an essential part of meeting the legal requirements for competent, trained staff. The enhanced risk, albeit in a controlled manner, of realistic training is balanced by the higher level of competence and confidence in the real-time incident.

Conclusion

There is no simple answer to the dilemma posed in this paper. Firefighters will always be under considerable pressure at operational incidents to respond, with a perceived potential for conflict between responding and applying high standards of health and safety. In practice, good health and safety management systems are sufficiently flexible to enable appropriate, context-specific standards to be implemented with overall benefits for a safe, effective and efficient response. This can be achieved in fire and rescue services that are committed to the process and have good, clear leadership on the issue.

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Notes

[1] Retained fire fighters provide an 'on call' part-time service. They respond to fire and emergency calls in the same way as wholetime firefighters, using the same appliances and equipment. The difference is that the retained firefighters are 'on call' in their homes rather than at a station. They respond when needed and are paid primarily for responding to risk. Retained firefighters are paid an annual retainer fee, for which they provide agreed on-call hours each day or week over the year. They are also paid for turning out in response to calls, for attending incidents and for attending training. Volunteer firefighters are not paid a retaining fee and do not contract hours of on-call cover, although they are available to respond to calls in many ways similar to retained firefighters. Volunteer units tend to be in very rural areas and are generally supported, when they are called out, by the nearest retained or wholetime unit.

[2] The Special Constabulary is the United Kingdom's part-time police force. It is made up of members of the public who volunteer to spend some of their time helping to police their local community. Specials work alongside their regular colleagues and have the same powers in law, within their area of jurisdiction.

About the Author

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Issues Involving the Safe Operation of Fire Department Tankers

Abstract

This article provides an overview of the issues surrounding the abnormally high incidence of crashes involving fire department tankers, also called tenders in the Incident Command System. These are the deadliest vehicles in the American fire service. The article examines the issues surrounding this high crash rate and provides recommendations for mitigating them in the future.

The Problem

Without question, the fire service has seen more emphasis and effort directed toward the cause of firefighter safety during the past 20 years than in any other similar period within the history of organized fire protection. Standards to improve safety have been developed and the apparatus and equipment available to firefighters are better than ever. We now have rehabilitation operations and rapid intervention teams to better ensure our firefighters' safety. Safety is emphasized in our training and in our daily operations. We have safety officers to make sure we follow the safety procedures.

Despite all of this talk and awareness of the importance of safety, the fire service still manages to kill roughly the same number of firefighters every year as they did 20 years ago. This statistic is made sadder by that fact that nearly all jurisdictions report significantly lower numbers of structure fires than 20 years ago. If you were to develop a ratio of working fires in the U.S. to number of firefighter fatalities, you would actually see an increase in firefighter deaths per "x" number of fires today over 20 years ago.

Even more remarkable is the fact that the manner in which firefighters are being killed in the line of duty has not changed significantly over the past 20 years. Every year statistics compiled by the National Fire Protection Association (NFPA) and the United States Fire Administration (USFA) consistently indicate that roughly one-half of the firefighter deaths are the result of cardiovascular emergencies. The next biggest cause of firefighter deaths are injuries received as a result of collisions while responding to or returning from emergencies. Vehicle collisions account for roughly 25 percent of all firefighter fatalities each year (USFA Tanker Report, 2003). This article will address one particular facet of the issue surrounding safety in responding to or returning from emergency incidents: the safe operation of fire department tankers.

In this article, the term *tanker* is used to describe a ground vehicle used to supply fire fighting water to rural and suburban locations not equipped with a fixed water supply system. In jurisdictions that utilize the Incident Command System, these types of vehicles are referred to as tenders or water tenders. The generic term applied to these vehicles by the National Fire Protection Association (NFPA) is "mobile water supply apparatus." To meet the definition of a mobile water supply apparatus according to the NFPA Standard 1901, *Standard for Automotive Fire Apparatus*, a vehicle must carry a minimum of 1,000 gallons of water (NFPA 1901). The most common water capacities of tankers in the United States range from 1,500 to 3,000 gallons. Capacities of up to 5,000 gallons on a straight chassis and 10,000 gallons on a tractor-trailer apparatus are not unheard of.

Before moving to a discussion on operating tankers, it is important to note that the annual statistics kept by the NFPA and USFA indicate that nearly one-half of the fatalities that occur while responding to or returning from incidents are volunteer firefighters operating their personal vehicles (POVs). Clearly, the loss of one of these volunteers is too many and we should make every effort to avoid these deaths. However, one should not lose sight of the true scope of the issue related to volunteers crashing their POVs. When you compare the volunteer response to a typical fire compared to the career response, it becomes apparent that the odds are stacked against the volunteers. For example, look at the typical car fire. If a car fire occurs at 16th Street and Roosevelt in Phoenix, Arizona, at 9 pm this evening, 4 firefighters get on Engine 11, respond to the fire, put it out, and go home. This car fire resulted in the movement of one fire department vehicle. If the same car fire occurs at 9 pm this evening in the suburban community of Pennsburg, Pennsylvania, Montgomery County fire dispatch activates Pennsburg's pagers and, on average, 20 "fire department vehicles" begin their movement. Fifteen of these are firefighters heading to the station and five are fire police officers heading to the scene. Once at the station, the firefighters will respond two to three apparatus to the scene. Thus, the same car fire in a different type of response area resulted in the movement of 22-23 vehicles. Simple mathematical odds tell us that the car fire response in Pennsburg is 22-23 times more likely to result in a collision. Looking at fatalities in this context, the fact that 50 percent of the firefighters killed

in collisions are volunteers in POVs does not seem so disproportionate. This does not mean, however, that they cannot be reduced as well.

An even more interesting and alarming statistic becomes evident when reviewing the fatalities of the remaining firefighters killed while responding to or returning from an incident. Next to volunteers in POVs, the second highest number of response-related deaths occur in fire department tankers. During the period from 1990 through 2001, 22 percent of firefighter response fatalities occurred in tankers. During that 12-year span, 42 firefighters died in 38 tanker crashes (USFA Tanker Report, 2003). In fact, during this period more firefighters were killed in tankers than in pumpers and aerial apparatus *combined!* The USFA estimates that approximately three percent of the fire apparatus in the United States are tankers (USFA Tanker Report, 2003). It does seem that three percent of the vehicles being responsible for 22 percent of the response deaths is a very disproportionate number, thus the basis for this article.

The alarming rate at which fire department tankers are involved in serious crashes led the USFA to commission an in-depth study of this problem. Since its inception, the USFA has been committed to enhancing the health and safety of emergency response personnel. Fire service personnel across the United States rely on the USFA for current information and state-of-the-art guidance on critical fire service operational issues. In May 2003, the USFA released a report entitled *Safe Operation of Fire Tankers* that contains a detailed study of the issues surrounding the high crash and death rates involving tankers and information on how these incidents can be avoided in the future. Any fire department that operates tankers should obtain a copy of this free report. Printed copies of the report can be ordered and an electronic version can be downloaded at www.usfa.fema.gov.

Statistics On and Causes of Tanker Collisions

This section examines in closer detail some of the statistics and causes associated with fatal tanker collisions that occurred in the U.S. during the period of 1990 through 2001. It is important to note that the research used to develop the USFA report, which forms the basis for this article, was limited to collisions that involved the death of one or more firefighters. Because of the weakness of data collection throughout the fire service, it is impossible to get complete, accurate, and/or reliable information on tanker collisions that did not involve fatalities. Thus, the information contained in the larger report and this article provides insight into the factors associated with the types of collisions that possess the greatest potential for harm to firefighters.

Hypothetically, there is some suspicion that if it were possible to collect data on tanker collisions that were not fatal to a firefighter that some of the results would slightly different than those reported here. For example, we know that the most dangerous place during an emergency response and the location most likely to be involved in a collision is in an intersection (IFSTA, 2000). However, as we note below not a single fatal tanker accident in this study showed an intersection as being the primary contributing factor to the collision. This finding does not mean that tankers pose less of a danger going through an intersection than other fire apparatus. Tankers are just as likely to be involved in intersection collisions as any other emergency vehicle. However, using the Gordon Graham "Rule of Lug Nuts" (s/he who has the greater number of lug nuts wins), it is likely that the vehicle a tanker collides with in an intersection is considerably smaller than the tanker, resulting in less danger to the tanker and its occupant(s) than the other vehicle. With these caveats stated, we now review some of the statistics and causes associated with fatal tanker collisions.

Who Is Involved In Tanker Crashes?

As noted previously, during the period 1990-2001, 38 fatal tanker collisions in the United States resulted in 42 firefighter fatalities. Thirty-four of the collisions involved the death of one firefighter and four of the collisions were fatal to two firefighters each. All 42 of the individuals killed in these crashes were volunteer firefighters. The fact that volunteer firefighters accounted for all of the crashes and fatalities during this study should not be a surprise, and is not an indictment of volunteers. Volunteers generally protect rural areas where tankers are most needed. Road conditions in the areas protected by volunteers also tend to be more challenging (more hills, sharp turns, and poor road conditions) than those in areas protected by career firefighters. Therefore, it is only natural that volunteers would account for most crashes involving tankers. Shortly after publication of the USFA report, a female career firefighter in North Carolina was killed when she lost control of a tanker while driving to a training exercise (IAFF, 2006). Career drivers are not immune from the dangers that tend to more often strike volunteers.

Statistics indicate that age and driver/operator experience may play a factor in the likelihood of a serious tanker crash (see Table 1). In the cases that were reviewed, the age group of 20 to 29 year-olds ac-

Table 1: Age of Drivers in Fatal Tanker Collisions

Age of Driver	Number of Fatal Crashes
Under 20	3
20-29	10
30-39	6
40-49	4
50-59	4
60-69	4
70 and over	2
Unknown	5

counted for the largest number of fatal tanker crashes. This would tend to show that inexperience might be a significant causal factor in tanker crashes. This is also reflective of standard insurance industry actuary rates for correlating age and crash frequency.

It is also interesting to note where the victims who were fatally injured were riding on the apparatus at the time of the crash. Thirty-one of the 42 victims were the drivers of the apparatus. This is probably because it is quite common for a tanker to respond with only the driver on board. Four of the documented crashes involved the death of both the driver and the right front seat passenger. There were only seven crashes in which the passenger was killed but the driver survived (USFA Tanker Report, 2003).

Time of Day

A review of the reported times that the crashes occurred shows that most tanker accidents occur during daylight hours. As Table 2 shows, the time of noon through 6:00 pm accounted for 55 percent of the fatal tanker crashes. This statistic is consistent with other studies of fire apparatus and other emergency vehicle crashes.

Table 2: Time of Day for Tanker Collisions

Time of Day	Number of Fatal Crashes
Midnight to 2:59 am	1
3:00 am to 5:59 am	3
6:00 am to 8:59 am	0
9:00 am to 11:59 am	2
Noon to 2:59 pm	12
3:00 pm to 5:59 pm	9
6:00 pm to 8:59 pm	4
9:00 pm to 11:59 pm	5
Not Reported	2

Historically, USFA and NFPA annual fire loss reports show that the greatest percentage of working fires and responses take place at night. The fact that most tanker and other emergency vehicle crashes occur during daylight hours seem at odds with these fire statistics and has been the subject of much speculation. One possibility is that drivers are more confident when driving in daylight than in the dark. This confidence may translate into greater speed or overconfidence in driving ability. Both of these factors have been shown to be significant causes of emergency vehicle crashes. The reduced visibility that occurs during nighttime driving may actually save lives because it forces the driver to slow down. Other causal factors that may be responsible for more daytime collisions include more civilian vehicles on the road during this time of the day and the greater use of mutual and automatic aid in many jurisdictions on daytime responses because of decreased numbers of volunteers available in individual departments.

Factors Contributing to Tanker Crashes

The case history information that was available for the 38 incidents that were studied contained extensive information on the various causes and factors that led to the crashes. In virtually every case, there was more than one cause or factor listed as having played a significant role in the occurrence or the seriousness of the crash. Table 3 shows a compilation of the contributing causes for the 38 cases that were studied.

The data in Table 3 show that firefighters, like the public, must "click" their seat belts. There is a significantly greater chance of a fatal injury in a collision if seat belts are not used. This is evidenced by the fact that failure to wear a seat belt was noted in 31 of the 42 fatalities (about 74%). While failure to wear a seat belt is rarely the cause of a crash, it often plays a significant role in the severity of injury suffered. While there is no conclusive way to determine how many of these victims would have been saved had they been wearing their seat belts, it is a safe assumption that a large majority of them would have survived. This assumption applies especially to the 20 victims who were partially or totally ejected from the apparatus. A Department of Transportation (DOT) report indicates that the proper use of seat belts by heavy truck occupants reduces the risk of fatal injury by 60 percent and moderate-to-critical injury by 65 percent (NHTSA/DOT, 1999). The report notes, for large trucks:

- Three out of four people who are ejected from a vehicle will die.
- Eight out of ten fatalities in rollover accidents involve occupant ejection from the vehicle.
- Occupants are 22 times more likely to be thrown from the vehicle in a rollover accident when they are not wearing their seat belt.

When one examines the causes of tanker crashes, four major factors become apparent:

1. The apparatus wheels leave the right side of the road
2. Excessive speed
3. Overcorrection/oversteering by the driver when attempting to bring right wheels back onto the road surface
4. Failure to negotiate a curve

From those four major factors, two pairs of interrelated causes may be discerned. The first is the combination of allowing the apparatus wheels to drift off the right side of the road and overcorrection or oversteering when attempting to bring the wheels back onto the

Table 3: Factors Contributing To Tanker Crashes

Contributing Factors in Fatal Crashes	Number of Fatal Crashes
Failure to wear seatbelts	31
Wheels left the right side of the road	25
Excessive speed	21
Fatally injured individuals ejected from the apparatus	20
Overcorrection when attempting to bring right wheels back onto the road surface	19
Failure to negotiate a curve	17
Loss of control while descending a grade	6
Failure to follow posted speed recommendations on a curve	3
Mechanical failure	2
Poor road condition	1
Poor apparatus design	1
Driver inattention	1
Unknown	1
Impairment by prescription medication	1
Failure to stop at an intersection	1

road surface. In nearly two-thirds (66%) of the crashes that were studied, the apparatus drifted off the right side of the road. Once the right side wheels were off the roadway, in three-quarters (76%) of the cases, the crash then occurred as a result of the driver attempting to bring the vehicle back onto the roadway and then losing control. In the remaining cases, either the vehicle rolled over or struck an object (pole, guardrails, bridge rails, etc.) once the wheels were off the right side of the driving surface. We discuss how to avoid these types of crashes and safely bring a vehicle back onto the driving surface below.

The other pair of events that are typically interrelated are excessive speed and failure to safely negotiate a curve. In most cases, the reason the curve was not safely negotiated was because the apparatus entered the curve at an unsafe speed. In several of the cases that were studied, it was noted that the apparatus was well above the posted recommended speed for the curve on which the crash occurred. In many cases, even the posted speed limit for a particular curve may be too fast for a fire department tanker. These posted speeds are calculated based on a passenger-sized vehicle traveling on a dry road surface. Because of their excessive size, fire department tankers typically must be driven a slower speed than a passenger vehicle in order to safety traverse the curve.

Excessive speed is not only a problem when trying to negotiate curves. It is often the reason the right wheels drift off the road surface, the apparatus is unable to come to a stop at intersections, or the driver is unable to control the vehicle when a mechanical failure occurs. Simply slowing down and driving the apparatus at a reasonable speed will prevent a significant number of crashes from occurring.

Clearly, some of the information related to the statistics and causes of fire department tanker collisions would come as no surprise to anyone. On the other hand, some findings run counter to conventional wisdom, such as the lack of intersection crashes. Another finding emerging from the research that defies conventional wisdom is that only three of the collisions listed poor apparatus design or poor mechanical condition of the apparatus as causes for the collisions. Because many fire departments use retrofit vehicles (in many cases home-built) and surplus military vehicles as tanker apparatus, it has been assumed that this would be a significant factor in fatal collisions. Research did not support this conclusion. Research does clearly show that if firefighters (1) wear their seatbelts, (2) operate vehicles at a reasonable speed, and (3) keep the wheels of the vehicle on the driving surface they are much less likely to be involved in a fatal collision.

A Review of Case Histories

Case studies of fatal tanker crashes can highlight many of the issues and problems discussed previously in more statistical terms. The case histories are not offered as a way to demean or criticize the individuals and departments involved in these incidents. Rather, the hope is that these departments would want to share this information with the fire service so that other personnel and jurisdictions could avoid suffering the same tragedy. The case histories are taken from the USFA study of fatal fire department tanker crashes that occurred between the years 1990 and 2001. The histories are based on a number of sources, including insurance company records, USFA records, U.S. Department of Justice Public Safety Officers' Benefit (PSOB) data, and a variety of other private and governmental sources.

Case Study #1 – Right-Side Wheels Leaving the Road Surface

This crash occurred in North Carolina at 17:20 hours on January 14, 1995. In this incident a 49-year-old male firefighter was the driver of a tanker responding to a report of a smoke odor in a manufactured home. A second firefighter rode as the front-seat passenger in the vehicle. Members of the first fire apparatus unit to arrive at the manufactured home were told by other firefighters, who had responded directly to the scene in their personal vehicles, that an emergency did not exist. The operator of the first unit informed other responding units by radio to reduce their response mode to non-emergency. Firefighters standing near the first-arriving truck heard the sound of the tanker's crash at approximately the same time the message was being transmitted.

It was later determined that the right wheels of the tanker left the roadway. Without sufficiently slowing the vehicle, the driver steered the truck back onto the pavement. This caused the rear end of the tanker to come around and the apparatus began to slide. The tanker exited the left side of the road, rolled, and collided with a natural gas distribution substation. A second tanker following the one that crashed alerted other firefighters to the crash. When firefighters arrived on the scene, they found the tanker entangled in the natural gas substation with large amounts of natural gas being released. A hazardous materials response team from a nearby city was called to the scene. Once the team arrived, the two firefighters were removed from the tanker and transported to the hospital. The driver was pronounced dead at the hospital, the firefighter who had been a passenger in the tanker received serious but non-fire threatening injuries. Neither firefighter was wearing a seat belt. The cause of death for the driver was listed as multiple blunt force injuries to the head, chest, and abdomen. The law enforcement report on this incident cited excessive speed as a contributing circumstance to the crash.

Lesson to be Learned: This incident was a classic example of the need to keep all of the vehicle's wheels on the road surface at all times. If for some reason the right-side wheels drop off the road surface, the apparatus should be slowed to a speed of 20 mph or less before attempting to bring all the wheels back onto the road. Neither of the occupants of the tanker was wearing seat belts, which contributed to the seriousness of their injuries.

Case Study #2 – Failure to Follow Posted Speed Suggestions on a Curve

This incident occurred in the state of Washington at 21:36 hours on April 8, 1996. The 19-year-old male firefighter who was fatally injured was the driver of a 3,000-gallon tanker responding to a structure fire. The right front seat was occupied by another firefighter. Neither firefighter was wearing a seat belt at the time of the crash.

A local bridge was out of service for repair so the response route taken to the fire was unfamiliar to both firefighters. The fire chief, who was following the tanker in his vehicle, was more familiar with the route. As the tanker approached a curve, the fire chief realized that the driver was accelerating and ordered the tanker, by radio, to slow down. The order came too late and the tanker entered the curve at a speed estimated to be 40-60 miles per hour. The recommended speed for passenger-sized vehicles in the curve was 35 miles per hour. The tanker skidded, rotated counterclockwise, and then left the right side of the roadway. The tanker rolled first onto its right side, then onto its roof. The cab was crushed as it slid for a distance. The tanker rolled again and came to rest on its left side.

The fire chief and another chief officer who was riding with him immediately requested assistance. They found the passenger attempting to self-extricate and helped him out of the vehicle. They had a great deal of difficulty removing the driver due to his position in the cab of the truck. He was eventually removed with the assistance of a passing motorist. CPR was begun immediately and continued while the driver was transported to the hospital. The driver was pronounced dead shortly after his arrival at the hospital. The cause of death for the driver was listed as a lacerated heart and major vessels.

Lesson to be Learned: Driving the tanker at a safe and reasonable speed is always important. However, it becomes even more critical when operating the vehicle on unfamiliar roads. In this incident the driver was not familiar with the route being traveled and entered a curve at a speed beyond that which the tanker could safely be operated. This resulted in a rollover crash. Once again, failure to wear safety belts likely contributed to the seriousness of the injuries. The young age of the driver would also tend to lend support to lack of driver experience being a factor in this incident.

Case Study #3 – Excessive Speed

This crash occurred in West Virginia during daylight hours on November 19, 2001. A 32-year-old former chief officer was driving the tanker and a 21-year-old firefighter was riding as a passenger in the front right seat of the cab. The 2,000 gallon tanker was following a pumper that left the same fire station and was en route to provide mutual aid at a brush fire. Prior to the crash, the tanker was descending a steep grade that contained a horseshoe curve at the bottom of the grade. The driver/operator reported that the vehicle's brakes failed while descending the grade. In an effort to slow the apparatus, the driver steered it into the shallow ditch along side the road. When the tanker reached the horseshoe curve at the bottom, it left the roadway, overturned, and slid down an embankment, nearly striking the pumper traveling ahead of the tanker that had completed the turn and was heading back towards the tanker. The water tank detached from the apparatus and slid further down the embankment. Both occupants

were trapped in the apparatus cab. The passenger was pronounced dead at the scene and the driver/operator was airlifted to a trauma center where he recovered.

The ensuing investigation determined that the tanker's brakes were slightly out of adjustment. However, it was determined that the more important causal factors were that the driver/operator was driving under the influence of alcohol and he was operating the vehicle at an unsafe speed. The driver/operator was terminated from the fire department, convicted of criminal charges, and given a considerable prison sentence. A lawsuit by the victim's estate was settled out of court prior to the start of a trial.

Lesson to be Learned: Operating the vehicle with a clear, unimpaired mind and at a safe and controllable speed will go a long way toward making it safely to the emergency scene. Failure to do so can result in a catastrophic incident, along with criminal and civil legal ramifications.

These three cases studies offer real-life proof of the information provided in the statistical review of fire department tanker crashes. The people who were injured and/or killed in these incidents, as well as the people they left behind, are real people who will struggle with the consequences of these crashes for the rest of their lifetimes. It is crucial that we do everything in our power to avoid these crashes in the future.

Strategies for Improving Tanker Safety

In order to ensure the validity of the information contained in the 2003 USFA publication entitled *Safe Operation of Fire Tankers* discussed above, a group of subject matter experts served as peer reviewers of the report.[1] The panel developed a list of twenty crucial items that can be addressed to minimize the frequency and/or severity of fire tanker crashes (USFA Tanker Report, 2003). These items include:

1. Operate the tanker at a safe and reasonable speed. Never drive the tanker faster than a speed at which it can be fully controlled. Never exceed the posted speed limit when driving under nonemergency response conditions. Recognize that in many situations even the posted speed limit is too fast for a tanker to be operated in a safe manner.
2. The cautionary speed signs that accompany road signs indicating curves in the road should be considered the maximum speed for a tanker driving on these curves in any condition. In many cases, the suggested speed may be too high for tankers because they are developed for passenger cars on dry roads. In most cases, it will be necessary for the tanker to take the curve at a speed slower than what is posted.
3. It is recommended that new tankers exceeding a GVWR of 32,000 pounds be equipped with antilock braking systems. NFPA 1901 requires antilock brakes for all vehicles exceeding 36,000 pounds. However, the subject matter experts that reviewed the USFA report felt that the NFPA limit was too high and suggested a more conservative approach for fire departments.
4. Keep all of the wheels on the primary road surface at all times. Having the tanker's right-side wheels drift off the edge of the road is one of the most common causes of tanker crashes. It was responsible for two-thirds of the fatal collisions in the cases discussed above. If the right-side wheels do get off the edge of the road, do not try to bring the apparatus back onto the road surface at a high speed. Slow the apparatus to 20 mph or less before trying to bring the wheels back onto the road surface.
5. Travel with the water tank either completely empty or completely full. This minimizes the effects of liquid surge within the tank. This is a good idea even if the tank is properly baffled, and it is crucial if the tank is not properly baffled.
6. Avoid operating retrofit tankers if at all possible. Although the issues associated with retrofit tankers did not prove to be a significant problem in the study of fatal collisions, the subject matter group agreed that it is a very significant problem in less serious collisions. Every attempt should be made to place in service tankers that were specifically engineered and designed for fire department operations.
7. Know the weight of your apparatus. All tankers should be weighed completely full and that weight should be posted (in units of pounds and tons) on a plaque on the vehicle's dashboard. This will help the driver to determine if it is safe to drive the vehicle on a road or bridge that has posted weight restrictions.
8. Require mandatory training for tanker drivers. This must include extensive training before being allowed to drive the tanker on public roadways and refresher training on a regular basis according the requirements of NFPA 1451, *Standard for a Fire Service Vehicle Operations Training Program* (2002) and NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program* (2002). Just because a driver has previously been certified to drive other fire department vehicles should not mean that they are allowed to drive the tanker if the need arises. Because of their larger size than most other fire vehicles and the tendency of their load (water) to affect the movement of the vehicle, the drivers must be specifically and thoroughly trained on the operation of the tanker before being allowed to drive it under emergency conditions.

9. Establish an effective maintenance program for the tanker and all other fire department vehicles. Many mechanical failures that lead to crashes can be prevented if the apparatus is inspected and maintained on a regular basis. Guidelines for establishing proper maintenance programs can be found in NFPA 1915, *Standard for Fire Apparatus Preventive Maintenance Program* (2006). It is recommended that apparatus be inspected at least weekly.
10. Use spotters when backing the apparatus. Even though cameras and other devices for assisting with backing the apparatus do provide some measure of safety, there is no substitute for having at least one and preferably two spotters to guide the driver while the apparatus is being operated in reverse. NFPA 1500 requires spotters for backing, regardless of whether the apparatus is equipped with cameras or other backing safety equipment. One spotter should be equipped with a portable radio in the event that they need to contact the driver during the backing operation.
11. Retrofit all tankers with back-up alarms. These devices warn other people in the area that a tanker is backing up. This will allow them to get out of the way before a crash occurs.
12. Come to a complete stop at all intersections containing a stop sign or red traffic light in your direction of travel. The most likely place to collide with another vehicle is in an intersection. Nearly all these crashes can be prevented if the tanker comes to a complete stop when faced with the signal to do so or with a stop sign. The tanker may proceed through the intersection after assuring that all other vehicles have granted them the right of way. If the tanker driver cannot be certain that all vehicles are stopping to allow the tanker passage, the apparatus should not proceed.
13. Wear your seat belt whenever the apparatus is in motion. While wearing a seat belt may not prevent a crash from occurring it certainly can minimize the risk to the driver (and the other occupants) in the event one does occur. A significant percentage of tanker accidents involve the vehicle rolling over and the driver and/or passenger(s) being thrown from the vehicle. The chance of serious injury or death is greatly multiplied when the occupant is thrown from the vehicle. Wearing of seat belts will prevent nearly all ejections from the vehicle.
14. Keep the windows rolled up. This will add an extra measure of security in preventing the occupant(s) from being ejected from the apparatus in the event of a rollover crash.
15. Be familiar with your response district and the roads in it. By being familiar with the various routes within the response district, the driver will be able to anticipate when approaching hazardous sections of roads, dangerous curves, and other hazards to safe vehicle response.
16. Avoid poorly constructed or unpaved roads whenever possible. Again, familiarity with the response district will aid the driver in this objective. It may be safer (and faster) to take a paved route that is longer than the shorter unpaved route to an emergency scene.
17. Limit the number of apparatus responding to an emergency to a reasonable, prudent number. Dispatching three engines, two tankers, a heavy rescue squad, and three chief officers to a reported car fire is overkill. The more vehicles that are on the road, the greater the odds that one of them may be involved in a crash.
18. Do not respond at an emergency rate (Code 3) when no emergency is known to exist. Apparatus have been involved in collisions while responding with lights and sirens to perform a coverup at a neighboring station. This is not an emergency. In addition, fourth-or fifth-due apparatus have been involved in crashes well after the initial apparatus arrived on the scene and found no fire or emergency condition. As soon as it is determined that no emergency exists, or that the initial arriving apparatus can handle the emergency, all other responding apparatus should be directed to reduce their response to a nonemergency rate.
19. Always have at least one firefighter accompany the driver of the tanker. The passenger can assist by operating warning devices, handling radio transmissions, and being a second set of eyes. The passenger should not hesitate to warn the driver when they feel that the tanker is being operated at an unsafe speed.
20. Practice driving the tanker in adverse road conditions. It is not reasonable to expect that a driver who has only been trained in daylight hours on clear dry roads will be qualified to operate the vehicle safely at night or in adverse weather.

Conclusion

Following the twenty points listed above will certainly lead to a reduction of the hazards associated with operating fire department tankers. The need to develop an effective driver training program and to enforce fire department standard operating procedures and policies cannot be overstated. These actions will have a profoundly positive effect on the safe operation of tankers, and for that matter all emergency vehicles.

The information contained in this article is only a small portion of the overall information contained in

the USFA *Safe Operation of Fire Tankers* report. Fire departments that operate tankers are strongly encouraged to go to the website cited earlier in this article and download a free copy of this report. This will be the first step toward improving the safety of the operation of tankers in your department.

Notes

[1] This group included: Gene P. Carlson, Volunteer Fireman's Insurance Services (VFIS); Jeffrey M. Dickey, National Association of Emergency Vehicle Technicians; Stephen N. Foley, National Fire Protection Association (NFPA); Paul S. Lukas, National Volunteer Fire Council (NVFC); Glenn McCallister, Semo Tanks, Rep. Fire Apparatus Manufacturer's Association (FAMA); Robert Murgallis, National Fire Academy; Eric D. Nagle, IOCAD Emergency Services; Kevin M. Roche, Phoenix Fire Department (Principal Project Researcher); Bill Troup, United States Fire Administration (USFA); Michael A. Wieder, Oklahoma State University, Fire Protection Publications (IFSTA) (Principal Project Writer); Michael Wilbur, Emergency Vehicle Response/Firehouse Magazine; Fred C. Windisch, IAFC, Volunteer & Combination Chief Officers Section; and Michael L. Young, Volunteer Fireman's Insurance Services (VFIS)

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Getting to the Heart of the Matter: Reducing Firefighter Line of Duty Deaths

Abstract

Fire fighting is a physically demanding and dangerous occupation. During the past ten years, there has been an average of 100 firefighter line-of-duty deaths (LODDs) each year. Consistently, nearly 50 percent of these LODDs are cardiac related. Also consistently, 50 percent of the cardiac related LODDs occur in personnel who have a cardiac-related history or who had cardiac-related signs that should have been noticed on a pre-employment or fit-for-duty physical. Simply stated, some fire administrators are not taking an appropriate leadership role in ensuring firefighter candidates receive the appropriate physical screening prior to being hired or that incumbent firefighters are in the physical condition necessary to complete the demanding tasks of their job. The purpose of this article is to help establish the role that fire leadership and management plays in ensuring that (1) new recruit firefighters receive the appropriate medical screening according to NFPA 1582, Standard on Comprehensive Occupational Medical Program for Fire Department, (2) incumbent firefighters receive annual fit-for-duty assessments, and (3) incumbent firefighters remain in the physical condition necessary to accomplish the demanding tasks of a firefighter through the course of their career. Based on a review of existing literature, the results of a national survey, and firefighter LODD reports, recommendations are offered to reduce firefighter line of duty deaths due to cardiovascular causes.

Introduction

According to the United States Fire Administration there were 106 firefighter line-of-duty deaths (LODDs) in 2005 (USFA, 2006); in 2004 the number of firefighters who died in the line of duty was 112 (USFA, 2005). Consistently there is an average of more than 100 firefighter LODDs each year. Since 1977, there have been only four years where the total number of firefighter LODDs has been less than 100 (1996 with 99 and 1998 with 93). Of the 66 stress-related deaths in 2004, 61 firefighters died of heart attacks, four died as a result of cerebrovascular accident, and one died of an aortic aneurysm (USFA, 2004).

In 2005, the National Fire Protection Association (NFPA) conducted a 10-year study of firefighter LODDs. According to the NFPA (2005), during the period of 1995-2004, there were 1,006 firefighter LODDs. Of the 1,006 on-duty fatalities, 440 (43.7%) were from heart attacks, also known as sudden cardiac death (NFPA, 2005). According to this study of sudden cardiac deaths of American firefighters, almost half of the firefighters who died from heart attacks had known heart conditions, and another third had heart conditions that simple medical testing could have detected (NFPA, 2005). In our home state of Florida, during the past two years three recruit training deaths occurred due to cardiac-related events. These were young men in the prime of their lives whose cardiac problems could have and should have been diagnosed during their pre-entry physical exam. Most applicants to fire training academies are left to choose their own physician for pre-entry physical exams, and many times that ends up being a "walk-in" clinic or the long-standing family physician. The consistency of these statistics has been recognized by the NFPA, USFA and the National Fallen Firefighters Foundation (NFFF), as well as other firefighter and chief officer organizations, as being a serious problem that needs to be addressed immediately.

Research reported here suggests that some firefighters who were medically cleared for firefighter training had preexisting and/or undiscovered coronary problems and should never have been cleared for the rigors of fire fighting. Additionally, only those physicians trained in occupational health or sports medicine should be conducting these examinations, and then only if they have been provided with NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Departments* as a guide. Unfortunately, this is seldom the case. When NFPA 1582 is provided to physicians, there is some doubt that it is being read and followed because of its voluminous content.

The purpose of this article is to establish the role that leadership and management must play in fire departments to ensure that new recruit firefighters receive appropriate medical screening prior to hiring. In addition, incumbent firefighters must receive annual assessments and medical monitoring throughout their careers, as directed by NFPA 1582. Specifically, the research seeks to answer the following questions regarding fire service leadership in reducing sudden cardiac LODDs:

- Do firefighter candidates and incumbent firefighters receive proper physicals and fit-for-duty

assessments in accordance with NFPA 1582, both prior to and during employment?

- Do active paid and volunteer firefighters participate in ongoing job-related physical fitness throughout the course of their careers?
- Are active paid and volunteer firefighters educated in the benefits of and strongly encouraged to follow a healthy diet, both on and off-duty?

Based on a review of the literature, the results of a national survey of fire service leadership (chief officers of accredited agencies and students within the National Fire Academy's Executive Fire Officer Program) and fire training directors (nationally and within Florida), and three recent line-of-duty death reports from the State of Florida, we attempt to provide answers to the research questions posed above.

Findings

It is widely documented that fire fighting is a physically demanding occupation. Smith, Manning and Petruzzello (2001), for example, state, "Firefighting is a physically and psychologically demanding profession…"(p. 244). According to Soteriades et al. (2005), "Firefighters are expected to perform at near-maximal heart rates physically demanding job tasks…" (p. 1757). Moe et al. (2002) found, "Firefighters must perform physically intense work under conditions which increase myocardial oxygen demand, such as high temperatures and carbon monoxide inhalation" (p. 588). Mendenhall et al, (2005) found, "firefighters are regularly confronted with situations demanding levels of sustained physical effort often exceeding their physical working capabilities, thus resulting in stress, overexertion, and heart attack" (pg. 51). Davis, Jankovitz and Rein (2002) wrote, "…during firefighting emergencies firefighters' heart rates were sustained 88 [+/-6] % of maximum which was estimated to be equivalent to 63 [+/-14] % of maximum oxygen uptakes…" (p. 363). Clark (2002) reported, "Firefighting-related job tasks require high levels of physical fitness for workplace effectiveness and safety" (p. 940).

Fire fighting requires a high degree of muscular strength and aerobic capacity, sometimes for several hours at a time. The physical demands placed on firefighters, such as climbing stairs, pulling hose, raising ladders, chopping holes, forcing entry, and conducting searches for lost or trapped victims are exacerbated by the weight of the protective equipment they wear when conducting fireground operations (which can weigh 35 pounds or more) and the fire fighting equipment they either carry or use.

The nature of work and duration of work that a firefighter can be assigned on the fireground may cause a firefighter's heart rate to be at near-maximal heart rates for long durations of time (Melius, 2001). It has also been found that a firefighter's heart rate may elevate immediately upon notification of an alarm and stay elevated near maximal heart rate for the duration of the incident (Melius, 1995). The presence of a high heart rate is often compounded by working in extremely high temperatures. Smith and Haigh (2006) report that,

> The physical and physiological strain that results from firefighting is from a combination of several factors, including performing heavy muscular work, performing strenuous work while wearing heavy protective gear (including SCBA), working in hot and hostile environments [emphasis added], and working under conditions of emotional stress. (p. 175)

The cardiovascular response in a firefighter who answers an alarm is very high. One study conducted showed that performing sudden exercise without the benefit of a prior warm-up can produce an ischemic condition in the heart (Barnard & Duncan, 1975). The heart rate in firefighters who are responding to an alarm shows average increases of 50 beats per minute within the first 30 seconds of an alarm dispatch, and this increase in heart rate persists throughout the response to the alarm (Guidotti & Clough, 1992).

In a study conducted by Barnard & Duncan (1975), 35 firefighters ranging in age from 23 to 42 years all in good health without any symptoms of heart disease were monitored for their heart rate responses from prior to an alarm through returning from the alarm. This included the alarm dispatch, travel time to the incident on the fire apparatus, working during the incident, and returning to the station. It was found that fifteen to thirty seconds after the announcement of an alarm, the firefighters' mean heart rate increased by 47 beats per minute. While responding to the alarm, one minute after the alarm announcement, heart rate values were still 30 beats per minute above that recorded before the alarm sounded (pg. 247).

In another study, nine of 90 randomly selected, aged 40-59 year old firefighters were found to have electrocardiogram (EKG) changes indicative of coronary artery disease consistent with the general population (Barnard, et al. as stated in Guidiotti & Clough, 1992). Even though these numbers were found to be consistent with the general population of this age group, firefighters are selected by stringent fitness criteria that are commonly known as the "healthy worker theory." Equally enlightening was the fact that four of the six firefighters with EKG abnormalities indicative of myocardial ischemia showed no signs of advanced coronary artery disease. It was surmised that not only was it possible that an exposure to carbon monoxide could cause this, but it could also be the result of elevating catecholamine (Barnard, et al as stated in Guidiotti & Clough, 1992). Another study of firefighters' heart rate responses found that they had a higher incidence of ischemic responses to a standard near-maximal exercise test (Barnard & Duncan, 1975).

Additionally, although it has been understood for quite some time that an increased heart rate results from the strenuous activity of fire fighting, recent research has shown that during these strenuous bouts of fire fight-

ing activity cardiac stroke volume does not continue to increase (Smith and Haigh, 2006). According to a study conducted by Smith and Petruzzello (1998), the decrease in stroke volume may have a serious negative effect on blood pressure in that cardiac output may be compromised by virtue of the dilation of blood vessels attempting to rid the body of heat.

As was stated earlier, the NFPA has also found that almost half of the firefighters who died of heart attacks had known heart conditions. A third of these had heart conditions that **simple medical testing could have detected** (emphasis added) (NFPA, 2005). This state of affairs exists despite NFPA 1582 (2003) requirements that:

> Medical evaluation of candidates including history, examination, and laboratory tests as indicated shall be performed on each candidate in order to detect any physical or medical condition(s) that could adversely affect the candidate's ability to safely perform all essential job tasks under emergency conditions (Chapter 6, 6.1.1).

Also according to NFPA 1582 (2003): (1) "The fire department shall establish and maintain a confidential medical evaluation program for members" (Chapter 7, 7.1); and (2) "Medical evaluations shall be conducted as a baseline for surveillance and annually thereafter" (Chapter 7, 7.2).

The State of Florida has a statutory responsibility to investigate all firefighter LODDs and injuries that require more than a 24 hour hospital stay. Three recent LODDs emphasize the need for fire departments to have physical examinations conducted by either fire department physicians or physicians who are familiar with and adhere to the requirements of NFPA 1582. The following is a synopsis of the three most recent LODDs experienced in the State of Florida:

- Case One: A male fire academy recruit 35 years of age had just completed a one-mile jog and was preparing his bunker gear for the day's drills. The candidate collapsed among other students who responded immediately with basic life support and continued until transportation arrived and initiated advanced life support. After arrival at the local emergency room, the firefighter candidate was eventually pronounced dead from "aortic valve stenosis," a condition which should have been discovered in his pre-employment physical (NIOSH, 2004).
- Case Two: A male fire department lieutenant, 43 years of age, had just returned to the station after participating in "Smoke Maze" training. The lieutenant sat down at the table for lunch and collapsed in the presence of the on-duty crew. The lieutenant was immediately provided with advanced life support and transportation summoned. Within minutes the lieutenant was transported to the local trauma unit and eventually pronounced dead from atherosclerotic cardiovascular disease, which should have been discovered during periodical physical exams (Florida Bureau of Fire Standards and Training, 2005a.)
- Case Three: A 23-year-old male fire academy recruit engaged in an exercise that required him to drag a 50-foot length of 2½-inch fire hose approximately 600 feet collapsed in the presence of other recruits and instructors. The recruit was immediately provided with basic life support until advanced life support and transportation arrived. Advanced life support was continued during transport to the emergency room where the recruit was pronounced dead of hypertrophic and arteriosclerotic cardiomyopathy, a pre-existing condition which should have been discovered through a pre-entry physical exam (Florida Bureau of Fire Standards and Training, 2005b).

The following NIOSH reports outline three recent firefighter LODDs nationally that were related to obesity.

- In November of 2005, a 38-year-old career fire captain suffered a pulmonary embolism (PE) as he was leaving his home to respond to a medical call. He was 69 inches tall and weighed 320 pounds; his BMI was 47.2 kg/m². A BMI of 40.0 kg/m² is considered extreme obesity (NIOSH, 2005).
- In May of 2005, a 58-year-old career firefighter suffered a sudden cardiac death during physical fitness training. He was 73 inches tall and weighed 300 pounds, giving him a BMI of 39.5 kg/ m². A BMI of 30.0 kg/m² is considered obese (NIOSH, 2005).
- In October of 2004, a 58 year-old career chief died of arrhythmia due to coronary artery disease. He was 69 inches tall and weighed 343 pounds, giving him a BMI of 50.6 kg/m². As stated above, a BMI of 40 kg/ m² and over is considered extremely obese (NIOSH, 2005).

Further research of these three LODDs found that hydration was not a noted contributing factor to death; water was available and hydration encouraged.

Between January 03, 2006, and June 19, 2006, the time frame used in the present study, there were 42 LODDs (USFA, 2006). Seventeen (about 40%) were heart attack victims, two victims (5%) were "Cerebrovascular Accident" (stroke), and another two (5%) were listed as "death unknown," although it is probable that these deaths will eventually be reported as cardiovascular related. Stress and overexertion, which usually results in heart attacks or other sudden cardiac events, continue to be the leading cause of fatal injury.

Survey Results

In order to gather data concerning the role of fire service leadership in reducing sudden cardiac LODDs in the ten year goal set by the NFFF, a survey (see Ap-

pendix A) was sent to the members of the following fire service organizations: 1) Florida Fire Chiefs Association, 2) National Association of Fire Training Directors, 3) Florida Fire Training Directors, 4) current students of Fire Chief rank in the National Fire Academy's Executive Fire Officer Program, and 5) Fire Chiefs of accredited agencies through the Commission on Fire Accreditation International (CFAI). Members in these organizations have the ability to make initial hiring decisions on firefighter candidates, direct candidates to receive a pre-employment/training physical, and are involved in ensuring the continued attendance at annual (or some other schedule) physicals. A total of 335 surveys were mailed, with 197 usable surveys returned (58.8%).

Additionally the Florida Fire Chiefs' Association offered the use of their survey website, "Zoomerang" which generated another 94 responses after weeding out those respondents who had completed the email survey. We have no means by which to determine the size of that audience to determine percentage of returns.

We received data from 30 states, the United States Navy and the Mohegan Tribe of Connecticut. Respondents included 150 Chief Officers (Fire Chief, Deputy Chief, Battalion Chief, Assistant Chief and Training Chief), seven Captains, four lieutenants, two firefighters and the rest were "others" who chose not to provide their ranks. Department size ranged from two firefighters to a department of 1009, including the Chief. Volunteer, career and combination departments all participated with combination departments representing the bulk of participants.

Survey results suggest that the importance of medical exams both before hiring and throughout a firefighter's career is not fully appreciated. Twenty-seven (13%) of the respondents said they did not conduct pre-employment physicals. Less than one-half of the organizations surveyed (43%), said their state's regulatory body required pre-employment physicals. About 7 in 10 (71%) of the respondents required the use of specific physicians who were familiar with NFPA 1582. When asked if there were physicians within their community capable of performing firefighter physical exams who were knowledgeable of NFPA 1582, 125 (64%) of the respondents stated they did not know if such physicians lived in their city.

Regarding periodic physical exams of incumbent firefighters, 128 (64%) organizations stated they required annual exams, while 25 (12%) said they only required annual physical exams for Hazardous Materials (Haz Mat) team members and firefighters over the age 40. Forty-four respondents (22%) performed no periodic health exams for incumbent employees. Unless these fire departments do not have Haz Mat teams, they are in violation of many state laws and federal regulations.

Only about one-half of the respondents (103 = 52%) reported that the physicians performing examinations were occupational physicians; another 37 percent were general practitioners, and 18 (9%) respondents stated they neither knew nor specified which physicians performed these critical examinations. When asked if the physician designated to perform these health exams was provided or was familiar with NFPA 1582, only 95 (48%) responded in the affirmative. Another 80 individuals (40%) responded negatively; either the physician was not familiar with NFPA 1582 or the respondent did not know if they were. Six percent of the survey participants failed to answer that question at all. Fifty-six percent (n=111) of the respondents said they had a physician on staff or under contract to review medical reports from examining physicians, many (82 or 41%) stated the Health Insurance Portability and Accountability Act (HIPPA) prohibited the practice.

Only 105 (53%) of respondents stated they included exercise stress testing as part of their health assessment protocol, while 102 (52%) still use chest x-rays. When asked what they would do if a firefighter was identified as having a cardiac illness or disease, less than one-half (47 = 24%) stated they would move the individual to a "non-combat" position. A mere 4 percent (n=8) said the person would be forced to retire, while 126 (64%) said the individual would be returned to duty unless specifically restricted by a physician. Twenty-seven (14%) of the survey participants said they would take no action or had no policy to address that occurrence. If an employee is surgically treated for coronary disease through by-pass surgery, angioplasty, or shunt implant, 70 percent (n=138) of the respondents stated they would return that firefighter to full duty unless specifically restricted by the physician; 22 individuals (11%) said the person would be moved to a "non-combat" position. Seven percent of the respondents said this scenario would result in mandatory retirement.

The survey also asked what would happen if an employee was determined to be obese. Surprisingly, 84 percent (n=165) of the respondents stated they did not include obesity in the fit-for-duty examinations. Perhaps this fact explains why 60 (31%) respondents stated they would take no action. Another question asked if the fire departments allowed on-duty time for physical fitness training, 172 (87%) survey participants said they allowed anywhere from one hour (36%) to unlimited time (35%), assuming nothing else was going on. Six percent of the individuals responding to the survey said policy did not allow for this activity while on-duty. When asked if they provided "healthy' diet menus designed by nutrition professionals, 135 (69%) of the survey participants responded they had not, while 140 (71%) said they "encouraged" shift personnel to follow a "healthy" diet.

As to the method of physical training afforded to firefighters, 143 (72%) participants stated they had weight rooms at the stations and another 48 (24%) had cardio and fitness machines at most or all stations. Twenty-three (11%) departments allowed personnel to jog through the neighborhoods that surrounded the stations while 14 (7%) permitting firefighters to play basketball.

A question was asked about the department's participation in the Assistance to Firefighters Grant program (AFG) since its inception. Among other operational and safety-related items, departments can seek funding from this grant source to purchase physical fitness equipment and institute medical physicals for their personnel. When asked if they had applied for a Fire Act Grant since 2001, almost all respondents said they had applied for grant funds (172 = 87%). When asked if they had requested physical fitness equipment through this grant program, 64 (33%) said yes.

When asked if they would require an autopsy in the instance of a line of duty death, 125 (63.45 percent) said yes. Only 98 (49.75 percent) said they had a line of duty death policy in place.

Discussion

This article has attempted to answer three questions regarding the role of fire leadership and management in reducing cardiac-related LODDs. The first question was: Do firefighter candidates and incumbent firefighters receive proper physicals and fit-for-duty assessments in accordance with NFPA 1582 prior to the beginning of training and as part of their continuing employment? Survey results discussed above show that a gap still remains in the development and enforcement of effective policies that can help save lives. More than 13 percent of the departments surveyed did not perform a pre-employment physical. Fewer than 65 percent of the respondents to the survey stated they have an annual or bi-annual medical exam program for incumbents. The intent of annual or bi-annual physical exams is to ensure the firefighter fitness. According to Kales and Christiani (2000), "Although most fire departments require recruits to pass certain physical standards, few departments require incumbent firefighters to maintain these physical standards" (p. 468). According to a survey conducted by the International Association of Fire Chiefs (IAFC), only 69.2 percent of career departments and only 46.6 percent of volunteer departments report they use an annual or bi-annual medical exam program (IAFC, 2006). Simply put, these numbers are too low. Additionally, only slightly more than half of the departments surveyed here required the use of occupational or sports medicine practitioners to perform these critical medical exams. As Florida's recent experiences showed, firefighters in training are dying of cardiac events that should have been detected in the pre-employment physical.

The types of physical exams performed become critical when reviewing the National Institute of Occupational Safety and Health (NIOSH) reports on firefighter fatalities. In almost every case, NIOSH recommended that fire departments discontinue routine annual chest x-rays unless medically indicated and to conduct exercise stress tests for those firefighters over age 45 or with two or more risk factors for coronary artery disease. Nevertheless, survey results reported here show that many fire departments did provide pre-employment physicals, fit-for-duty physicals, still conducting routine chest x-rays, and did not provide firefighters exercise stress tests.

It may be that applicants are handed a copy of NFPA 1582 and told to "go get a physical and give this to the physician to follow." Little thought is given to the qualifications of the physician, who may be a family general practitioner or work in a "walk-in" clinic. As to incumbent employees, Occupational Safety and Health Administration (OSHA) regulations require hazardous materials responders to have annual physical exams, which they generally do. The argument we advance here is that there needs to be a process by which the fire service can educate the medical community on the importance of performing NFPA 1582 guided physicals, and then identifying those practitioners in the community who are knowledgeable and qualified to perform such firefighter medical examinations. Although these medical examinations are costly and budgets are tight, fiscal help is available through negotiated discounts from group medical providers for a documented wellness program. Health Maintenance Organizations (HMOs) were created specifically for this purpose. Grants are also available through the federal government (e.g., the Fire Act grant). Physicians, clinics, and hospitals have wellness programs that provide sizeable discounts based on the number of people in the program. Offering "it costs too much" as an argument for not requiring such medical examinations just is not valid. Compared to the cost associated with a firefighter fatality, the cost of prevention is small -- both in terms of social and fiscal implications.

Based on the survey results reported above, when confronted with an incumbent firefighter diagnosed with a coronary illness, most chiefs would return that individual to line duty unless restricted by the physician. Sixty-three percent of the departments responding to the survey stated they would return a firefighter diagnosed with cardiac problem back to the line. Seventy percent of the individuals responding said they would return a firefighter who had undergone heart surgery to the line. We question the wisdom of these decisions, especially in light of the fact that nearly 50 percent of cardiac-related LODDs over the last ten years have occurred in individuals who have pre-existing or known cardiac problems. In this situation, would it not be in the firefighter's best interest to be reassigned to a non-fire fighting role or even medically retired?

The second research question addressed in this article focuses on whether active paid and volunteer firefighters participate in an ongoing job-related physical fitness program throughout the course of their careers. The literature is replete with evidence as to the demanding physical nature of fire fighting. "Firefighters need to keep exercising to maintain their performance level throughout their career" (Ball, 2006). The effects of increasing age on cardiovascular fitness are probably very important to the health and safety of firefighters. Research indicates that compared to 20-39 year olds, the LODD rate is six times greater for firefighters over

60 years old and three times higher for those 50-59 years old. Therefore, the maintenance of physical conditioning is important to firefighters as their career progresses (Kales & Christiani, 2000; Davis et al., 2002).

A firefighter can be considered an "occupational athlete," requiring the traits of strength, endurance, flexibility and cardiac conditioning (Lim, 2006). According to Morris (2006), "Aerobic activity has been demonstrated to improve cardiovascular health, which in turn lowers the risk of heart attacks" (p. 50). The physical and psychological stress that firefighters undergo during the course of their career requires them to be in excellent physical shape. Bolgiano (2004) claims, "Fire departments need to take a closer look at the physical wellness of their employees" (p. 83).

So, what are the fire chiefs, the chief executive officers of fire departments, doing to help prevent cardiac-related illnesses? It is well known by those in the fire service that during the shift, "slack time" is available after the apparatus has been checked for operational readiness, the station duties are done, and the training is completed. This would be an appropriate time for physical fitness. Seventy-two percent of responding departments provided weight rooms; only 25 percent stated they had cardiovascular and fitness machines at most or all stations. A smaller percentage of departments were still allowing their personnel to jog through the neighborhoods or play basketball on duty. Most said they allow some time, anywhere from one hour to "unlimited" time, as long as all other duties were completed; however, none said physical fitness was a daily requirement. Only 32 percent of the respondents stated they had applied for a fitness/wellness grant through the Assistance to Firefighters Grant. It appears that departments need to focus on the cardiovascular side of the physical fitness equation and take advantage of the heath/wellness grant funds available as well. Shiny new trucks and equipment will never be more important than the firefighters operating them.

Some fire chiefs contend it is not possible to "require" physical fitness because "of the union." In response to a question posed to him asking his opinion on mandatory physical fitness programs, the International Association of Fire Fighters General President, Harold Shaitberger stated (2003):

> I really believe in it, and that's difficult for chiefs to understand. I have to admit it is a very difficult concept, and that is mandatory yet not punitive. That means you have to participate, but the participation is based on improving oneself, measuring improvement. The whole goal is to create a healthier firefighter, but non-punitively and without actions being taken against an individual because of some measurement. (p. 39)

Mandatory fitness training needs to be negotiated, just like pay studies, retirement issues, and station assignments. Although these issues are important, no issue should be as important as the health and safety of firefighters.

The last question that guided this research was: Are active paid and volunteer firefighters educated in the benefits of, and strongly encouraged to, follow a healthy diet both on-duty and off-duty? Of 26 cardiovascular related firefighter fatality case investigations conducted by NIOSH in 2004, 13 (50%) were considered obese and 10 (38%) were overweight based on body mass index (BMI 25-29 is overweight and BMI 30 and over is obese). In a conversation about these investigations with a Safety and Occupational Health Specialist working in the National Institute of Occupational Health (NIOSH), it was stated, "…this is just a snapshot, but the fire service has a definite problem" (T. Baldwin, personal communication, June 1, 2006). As survey results above show, often departments do not have a fit-for-duty policy in place, and those that do often do not have a Body Mass Indicator (BMI) as a criterion within that policy. As the American Heart Association reminds us, "If you have too much fat -- especially if a lot of it is at your waist -- you're at higher risk for such health problems as high blood pressure, high blood cholesterol and diabetes. That increases your risk for heart disease and stroke" (AHA, 2006).

Most of the respondents surveyed indicated they "encourage" their personnel to eat "healthy" diets, but very few (27%) stated they actually provide their firefighters with "healthy diet" menus prepared by a nutritional professional. A study conducted in the state of Massachusetts showed that 76 percent of the respondents (firefighters) did not feel their employers were providing them with sufficient health information (Kay, 2001). According to Soteriades et al. (2005), "Periodic medical evaluations combined with diet and exercise is required to help address this problem and reduce the risks to the general population firefighters serve" (pg. 1756). Obesity and being overweight are significant contributors to sudden cardiac deaths. They are a result of energy imbalance over a long period of time. The cause of energy imbalance for each individual may be due to a combination of several factors. Individual behaviors, environmental factors, and genetics all contribute to the complexity of the obesity epidemic.

Finally, when a firefighter suddenly dies, it would seem critically important to learn how and why they died so that preventative measures can be implemented for the rest of the personnel. The surveyed departments were asked if they had a policy requiring an autopsy when a firefighter dies in the line of duty. Slightly more than half answered in the affirmative. Less than half of the respondents even have a Line-Of-Duty-Death policy of any type in place. A few respondents said, "We haven't had to face that yet."

The fire service must come to the realization that it is far less costly to maintain healthy firefighters than it is to bury them. Over the past several years the number one killer of firefighters is not fire, entrapment, falls, or any of the numerous other methods one would anticipate from such a hazardous profession. Rather, it is the all-too-common heart attack that will be the cause of

death. In response to the growing problem of firefighter obesity, heart attacks, and strokes, the International Association of Firefighters (IAFF) and the International Association of Fire Chiefs jointly created a wellness and exercise program for firefighters. As is stated in the Fire Service Joint Labor Management Wellness-Fitness Initiative (1997),

> The ultimate goal… is to improve the quality of life of all uniformed personnel. The project seeks to demonstrate the value of investing wellness resources over time to maintain fit, healthy, and capable fire fighters and EMS responders throughout their career. An effective program should realize significant cost savings in lost work time, workers compensation, and disability. In addition, through data collection and analysis, participating departments will create an invaluable database suitable for comparisons throughout the fire service. (p. 1)

The National Volunteer Fire Council (NVFC) also created a "Heart Healthy" program. According to the NVFC (2006), the goal of the "Heart Healthy" program is "… to reduce the number of firefighter deaths from heart attack. This mission will be accomplished by promoting a healthier lifestyle and by providing firefighters with fitness, nutrition, cholesterol and other pertinent information to assist them on the road to becoming heart-healthy" (p. 1).

In May, 2006, the NVFC was awarded a $1,000,000 grant from the Assistance to Firefighters Grant (AFG) program for phase four of its Heart Healthy Firefighter Program. Room for improvement exists, however; when we asked survey participants if they were implementing any of these programs, very few said they had done so.

On March 10, 2004, a symposium was held in Tampa, Florida, sponsored by the National Fallen Firefighters Foundation with the intent of taking positive steps toward reducing the annual number of LODDs in the fire service. What emerged was a list of "16 major initiatives" that will give the fire service a blueprint for making changes and reducing LODDs. On June 21, 2005, the International Association of Fire Chiefs (IAFC) joined with other firefighter organizations and scheduled the first "Stand Down for Firefighter Safety Day" (IAFC web site). The purpose of the Stand Down was for fire departments to review safety practices and procedures. This Stand Down was repeated the following year and hopefully will be repeated every year until firefighter LODDs have been substantially reduced. In terms of reducing cardiovascular deaths in the fire service, Smith and Haigh (2006) argue "…a multi-pronged approach is necessary, including medical and fitness standards for hiring personnel, periodic medical evaluations for current personnel, health and safety programs, fitness programs, and on-scene rehabilitation" (p. 175).

Recommendations

In 2004, the National Fallen Firefighters Foundation (NFFF) declared it was time for the fire service to do something to stem the rising tide of firefighter line of duty deaths. At the National Fallen Firefighters Life Safety Summit held in Tampa, Florida, that year, sixteen major initiatives were outlined that will give the fire service a blueprint for making changes (NFFF, 2004). This article addresses three of those 16 initiatives. First, it defines the need for a cultural change within the fire service relating to safety and health. An unhealthy, unfit firefighter not only jeopardizes his or her safety, but also others, including other firefighters and the general public being served. Second, we advocate the development and implementation of national certification and periodic recertification based on the duties firefighters are expected to perform. Finally, we call for the development and implementation of national medical and physical fitness standards that are equally applicable to all firefighters based on the duties they are expected to perform.

Before a candidate is allowed to begin training, s/he should be required to pass a total physical examination guided by the national standard, NFPA 1582. There should be periodic physical exams conducted that thoroughly adhere to the same standard. These periodic exams should occur no less than every two years through age 40 and annually beyond that age. Physicians and other medical providers who are authorized to perform firefighter medical exams need to be trained in the purpose and consequences of properly conducted examinations of personnel applying for and engaged in the profession of fire fighting. This effort should be coordinated through medical profession and national fire service organizations. Medical personnel must understanding the importance of using NFPA 1582 correctly when conducting firefighter physicals, the physical demands of the occupation and the necessity for fitness to meet these demands (regardless of age), and the gravity of approving a firefighter with a cardiac condition to begin a career in fire fighting, or continue to engage in fire fighting operations.

If fire chiefs believe their firefighters need to lose weight, they need to enact rules to achieve this objective, and enforce them. They can, for example, establish a relationship with the local school board and ask their nutritionist for "healthy" diet menus and post them in the fire station kitchen. The local school board hires dieticians or nutritionists to provide school children with healthy meals. There are numerous healthy heart websites that contain nutritional information. During budget preparations, chiefs must request funding for aerobic exercise equipment and find a room to put it in. They must require shift personnel to spend at least one to two hours per shift on the equipment. It is also important for the chief officer to lead by example and conduct physical fitness commensurate with their duty.

All fire fighting personnel should be required to submit to bi-annual physical exams to age 40 and annually thereafter. Fit-for-duty assessments should be required annually as well. The "authorized" physician conducting the exam should be authorized to order the firefighter

off line duty if a problem is found, and recommend reassignment or retirement if heart surgery is involved.

Fire departments should adopt a policy that requires an autopsy to be performed before any death benefits are awarded to the beneficiaries. In-depth investigations into the LODD should be conducted, even if that means bringing in "outsiders" to do it. Then we must learn the lessons offered and share the lessons learned. Finally, since there was very little mention of hydration policies or practices, the role that dehydration may play in contributing to LODDs from cardiac events, especially during training and actual emergency responses, must be researched further to determine the extent of the correlation between the two.

Conclusion

Fire fighting is a physically and demanding occupation. Out of the approximately 100 firefighters who die in the line of duty each year, nearly 50 percent of these LODDs are a result of heart attack or "sudden coronary death." Of these 50 percent, nearly half occur in firefighters who had pre-existing medical conditions that should have been discovered and that should have precluded them from the physically demanding occupation of fire fighting. The fire service has existing standards that promote annual fit-for-duty physical exams and prehire/entry physical exams. Almost 90 percent of the fire service is requiring pre-employment/entry physicals but only slightly more than half ensure that their firefighters are maintaining fit-for-duty condition. Even fewer departments are pro-active regarding health and fitness with regard to promoting ongoing fit-for-duty assessments, mandatory physical fitness, and the dissemination of nutritional information.

Ask any chiefs if they care about their firefighters and there will be a resounding affirmative tribute to the courage and "heart" of the crew. However, when it comes to taking care of those firefighters' hearts, that's a different issue. The leadership of the fire service needs to stop being reactive to the catastrophes of heart attacks and start taking a proactive role in preventing them. The tools and resources are available. There is financial help available, but sometimes not pursued. Clearly, there are exceptions to the statements made above; some departments are rightfully proud of their efforts to prevent heart attacks among their troops. One such department is the Orange County Fire Rescue Department (OCFRD) in Florida. With the help of Fire Act Grant funds, the department purchased a Mobile Fitness Evaluation Unit vehicle and staffed it with certified peer-fitness trainers. OCFRD also purchased exercise equipment for fire stations. The program, along with annual physicals and medical monitoring overseen by the Wellness Bureau, has reduced workers' compensation claims and costs by 63 percent. Efforts such as these should be taking place every day in U.S. fire departments.

We believe in our hearts it is time for change; a cultural change is the only cure for the LODD problem. It is possible to reduce LODDs from cardiac causes. In our day-to-day activities as well as our research we are trying to help change that culture. A change of culture requires fire service leadership and management. A change of culture that requires that "Everyone Goes Home."

Notes

[1] NFPA statistics vary from USFA statistics; NFPA only includes those deaths that occurred on-scene, or within hours of getting off duty with an on-duty complaint of not feeling well. USFA has adopted the presumption that a heart attack suffered by a firefighter, regardless of when it occurs, is job related and hence, "in the line of duty."

[2] Commonly known as a Fire Act Grant.

[3] The authors filed a Freedom of Information Act request from the Department of Homeland Security, the federal agency that administers the Fire Act Grant, for the statistics relating to how many fire departments have requested funding through the Fire Act Grant for wellness/physical fitness programs. The information was not received prior to the publication of this article.

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Appendix A

Survey Instrument

1. Do you require pre-employment/pre-entry physical exams in accordance with NFPA 1582?

   Yes: 170 86.29% No: 27 13.71%

2. Do you require the use of a specific physician familiar with NFPA 1582 for these physical exams?

   Yes: 141 71.57% No: 56 28.43%

3. Are you mandated by state law or rule to subject all applicants to a complete physical exam?

   Yes: 85 43.15% No: 105 53.30%

4. Does your state mandate / require compliance with NFPA 1582?

   Yes: 48 24.37% No: 140 71.07%

5. Is the physician who clears firefighters for work an:

   Occupational Physician: 103 52.28%

   Sports Medicine Physician: 4 2.03%

   General Practitioner: 73 37.06%

   Don't Know/Specify: 18 9.14%

6. Are there physicians in your general area who hold any of the specialized designations above but are not specifically identified as NFPA "qualified" physicians for your department's pre-employment physicals?

   Yes: 51 25.89% No: 21 10.66% Don't Know: 125 63.45%

7. Do you require the chosen physician to submit a comprehensive report?

   Yes: 110 55.84% No: 82 41.62% Don't Know: 4 2.03%

8. Do you have a physician on staff or contract to perform these exams or review reports prior to hiring the candidate?

   Yes: 111 56.35% No: 83 42.13% N/A: 2 1.02%

9. Do you require periodic physical exams of all incumbent employees?

   Annual: 128 64.97% Bi-Annual: 9 4.57% No: 44 22.34%

Schedule Dependant on Age: 25 12.69%

Please Explain: __Under 40 = Bi-annual/Over 40 = Annual

10. Do your periodic physical exams include exercise stress tests?

Yes: 105 53.30%

No: 85 43.15%

Don't Know: 7 3.55%

N/A: 15 7.61%

11. Do you require chest x-rays as part of your periodic physical exams?

Yes: 102 51.78%

No: 73 37.06%

Don't Know: 7 3.55%

N/A: 15 7.61%

12. Do your periodic physical exams include pulmonary function test for clearance for SCBA use?

Yes: 134 68.02%

No: 42 21.32%

Don't Know: 1 0.51%

N/A: 16 8.12%

13. If you encounter an employee with cardiac illness / disease, what actions are taken by your administration?

Moved to non-combat position: 47 23.86%

Mandatory Retirement: 8 4.06%

Returned to duty unless specifically restricted by physician: 126 63.96%

Other: _27__Please Explain: ___No Action Taken 13.71%

14. If an employee is surgically treated for cardiac disease through by-pass, angioplasty, or shunt implant; is that employee;

Moved to non-combat position: 22 11.17%

Mandatory Retirement: 13 6.60%

Returned to duty unless specifically restricted by physician: 138 70.05%

Other: 24 12.18% No Action: 4 2.03% N/A: 4 2.03%

15. Do you follow the IAFF / IAFC Wellness Program?

Yes: 53 11.68%

No: 113 57.36%

Not Familiar with it: 28 14.21%

16. Do you have a "Fit-For-Duty" policy requiring physical exercise and maintenance of minimum Body Mass Index?

Yes: 33 16.75% No: 165 83.76%

17. What actions are taken when an employee is determined to be obese? (CDC has established that a BMI in access 30kg/m² is obese.)

Restricted to non-combat duties: 8 4.06%

Ordered to take specific action and required to lose weight within a specific time period: 32 16.24%

Placed on administrative leave until sufficient weight is lost: 5 2.5%

Other: 83 Please Explain: ___Physician Recommendation 1.05%

NO ACTION 60 30.45% N/A: 6 3.05%

18. What is the time criteria (how many work days/shifts) your agency uses to require an employee who is off from work due to illness or injury to obtain clearance for duty from a physician?

Day / Shift:

1: 18 9.14% 2: 45 22.84% 3: 72 36.55%

More: 35 17.77% No Policy 7 3.55% N/A: 13 6.60%

19. Do you designate the physician for this clearance or are they allowed to see their personal physician?

Department Designated: 83 42.13%

Personal Physician: 118 59.90%

N/A: 2 1.0%

20. Is the physician you designate provided with or familiar with NFPA 1582?

Yes: 95 48.22% No: 38 19.29%

Don't Know: 42 21.32% N/A: 11 5.58%

21. Do you allow shift time for regular exercise and physical fitness training?

Yes: 172 87.31%

No: 16 8.12%

22. If yes to above, how much time per shift is allocated for PT?

1 Hour: 70 35.53%

2 Hours: 31 15.74%

3 Hours: 2 1.02%

4 Hours: 0 0.0%

Unlimited: 68 34.52%

N/A: 12 6.09%

23. Type of physical training used:

Weight Room: 143	72.58%
Local Gym: 22	11.17%
Neighborhood Jog: 23	11.66%
Basketball Court: 14	7.11%
Other: 48	24.37%
In-Station Fitness Center; Cardio machines available	
N/A: 6	3.05%

24. Has your department applied for a Fire Act Grant since 2001?

Yes: 172 87.31% No: 22 11.17% N/A: 3 1.52%

25. If yes, has your department even requested physical fitness equipment through the Fire Act Grant?

Yes_64 32.49% No: 113 57.36% N/A: 5 2.54%

26. Do you provide "healthy" diet menus designed by nutrition professionals?

Yes: 54 27.41% No: 135 68.53% N/A: 5 2.54%

27. Do you encourage shift personnel to follow a "healthy" diet?

Yes: 140 71.07% No: 51 25.89% N/A: 3 1.52%

28. Should your department suffer a Line-Of-Duty-Death, do you require that an autopsy be performed?

Yes: 125 63.45% No: 64 32.49% N/A: 3 1.52%

29. Do you have a Line-Of-Duty-Death S.O.P. or S.O.G?

Yes: 98 49.75% No: 93 47.21%

About the Authors

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Expert Panel Members' Comments

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Paper #1: "Developing a Safety Culture in the Fire Service," by Bill Pessemeir

The article opens with a strong indication that, despite the fact that the fire service is generally taken to be high-risk, it is not uniquely so, and reference is made to other "risky" in dustries in which significant safety achievements have been accomplished. I was immediately reminded of Machiavelli's comment on the resistors to change that:

> …there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new (*The Prince*, Chapter 6).

In this vein, the basis of this study is the identification of the internal factors that create and maintain the culture of organisations (and more pertinently fire departments) and an analysis of how these factors may be barriers to change. An opportunity exists to "take the ball another 5 yards" and also suggest how these same factors may present the opportunity for actually making the changes to which the study alludes.

The article refers to the history of approaches in analysing how safety failures had occurred leading the reader to the current ethos of organisational culture being held generally accountable. I tend to feel that the two other mentioned methods have remaining merit, however, and human factors, followed by socio-technical errors must firstly be eliminated from any investigation before *culture* can be held as responsible.

In discussing organisational culture, the report does a good job of indicating that: "for most organizations, a single dominant culture is present which provides the basis for how people in the organization think and behave," and that this applies in particular to the Fire and Rescue Service. I am reminded of my own experiences in which applicants are generally attracted by the supposed existent culture of a "gung ho" or "cowboy" mindset. This is often an untrue perception but having done little to counter it (seemingly due to a desire to demonstrate machismo) fire departments may be, by default, attracting exactly the type of person they do not want. The need to address service selection processes and standards is manifest. This would extend to the recruitment of both leaders and fire crew members. The need for screening that detects good and bad attitudes to safety cultures is implied (in much the same way as employers can *screen* for racist and homophobic tendencies).

Changing the *brand* is also relevant here. Items such as "Rolls of Honour," whilst important in paying tribute to our fallen colleagues, must be considered evidence of management failures. Those services that have core values that prize bravery or courage must review and counter such mindsets with equally important statements on caution and the introduction of awards for common sense, as well as for bravery, may be one such method of "re-branding." All of us who serve, or have served, as firefighters know that the line between heroism and foolishness is thin, and where any actions eventually are considered to sit is normally judged by the outcome – a somewhat flawed approach. In seeking to re-brand, we must also remember Chief Brunacini's "Mrs Smith;" stakeholder buy-in is vital.

The difficulties that may be encountered in changing culture are highlighted in the discussion of the *levels of organisational culture*, in which readers are directed to the difference between the outermost, artefact level (defined as visible organizational structures, processes and practices), and the second, espoused values level (defined as the shared values, beliefs, strategies, goals, mission and philosophies of the organization). Developing this argument further, the author indicates that the U.S. fire service may be "distorting, denying or falsifying" their collective memories to make the events that have occurred more acceptable. Whilst this suggestion is seemingly well-founded, the very personal processes by which people undergo the *distortion* process may not be the sole reason for this apparent organisational acceptance of it having occurred. It is worthy of note that, in my experience, those organisations with the most effective safety cultures almost always are highly effective businesses that are well managed and run. Although I cannot refer to research personally which substantiates this view, this seems too frequent to be coincidental. Recognising this as an established fact, in the UK, the government's Health and Safety Executive has coined the phrase 'Good safety is good business' and its principles form the basis of one of its milestone publications.1 It therefore almost seems paradoxical that fire and rescue services, which are apparently well run by highly effective managers, produce performance results that indicate that they are 'not good' at maintaining the heath, safety and welfare of their workers safety. One possible reason for this, as I discussed in my verbal feedback at RE06, is that the culture to which the study so accurately refers, also creates a mindset that masks true risk levels, seemingly rendering fire crews as unable to accurately gauge the personal risk to themselves in certain situations. We have all seen the hilarious videos of firefighters doing ridiculous things like using hot cutting equipment in flammable at-

mospheres, often with tragic results, but what has been learned? The reports into almost every major disaster show that interception opportunities were clear and indicators evident, but no-one saw it coming (or is that our cultures blinded us from seeing them for what they were?). The author draws statistical comparisons with the UK in one area, but there are significant differences in the legislative arrangements and the actual criminal prosecution of fire services when employees get hurt is not unknown. Steps are currently underway to create Corporate Manslaughter offences so that senior executives can be personally held to account. These are powerful drivers.

In considering the loss of comrades we, as brethren to those who bravely gave their lives, tolerate, empathise and privately accept the losses because we would not want in any way to diminish their memories and (it could be argued) our own status. If 9-11 had not been a terrorist atrocity, how many senior police and fire managers would stand accused of mismanagement? The "litmus" test for this may be to ask ourselves: Would it have been as acceptable, a loss to us, if it had been the result of a large, accidental fire?

The author referred to "repetitive failure behaviour" and identified a lack of learning. From the study, this seems to be due to some form of "industry arrogance." One common failing (that seems to infect the UK Fire Service in particular) is that every fire chief has the "tribal scars" of having been a firefighter. Until very recently, the UK fire and rescue service had single tier entry and all fire chiefs would have had to have been firefighters who worked their way up. This somewhat naturally gave them close association with the existing order of things and few examples exist of radical change leaders. In one way, the single progression method ensured that this could not happen. In recognising this, the government felt that, in order to change culture, it was vital to allow people from other sectors to come in at very senior levels. This was not done for safety reasons, or due to competence, but more to support a diversification agenda. The outcomes however are certain to be a change in culture although the "jury is still out" as to what effects that may have.

Safety culture is described and acceptance is given that to specifically define it in fire service terms is challenging. Good attempts are made to identify the elements of a safety culture, and it struck me at this stage that a possibility existed of defining the absence of a safety culture (of which the symptoms of failure are manifest) may have been more effective. The general proposal that safety cultures can be considered in the same fashion as organisational cultures is acceptable and well argued for. The motivation of service leaders to change the existing cultures must be clear and managed. When advocating successful reform managerial methods I make comparisons with Skinner's "carrot and stick" approach, favouring a dual approach, which rewards desired behaviours (and thus attracts individuals who manifest them) and punishes (or at least discourages) undesirable behaviours.

Comparisons are drawn against the UK and New Zealand's death statistics, but the stringent medical employment standards, the early retirement regimes and the legislative arrangements that punish poor safety manager harshly are likely to account for the apparent good levels in those countries. Equally, there may be other countries that more closely match the USA's statistics. A danger exists that the author will be accused of "cherry-picking."

In reading the article, I was convinced that it is possible that the 'new breed' of cultural flag bearers are damaged by the existing culture and, as well as addressing the type of entrant, services seeking change would seem to have to also change their systems, methods and managerial approaches to sustain the change. Otherwise, the new breed simply get immersed in the previously failing culture. I do agree with the author's assessment that, in those countries in which the risks (and associated injury statistics) are lower, the social credit is seemingly diminished. It should be noted that any new culture, that is attempted to be created, may only be sustainable if:

- business advantages are gained.
- our performance does not diminish (which would strengthen the arguments of resistors).
- our costs of operation are lower (a great business argument, which may require loss reduction due to better safety performance to be quantified)
- our societal benefit remains clear (many citizens may only be able to articulate our value by noting our personal sacrifices).

The article does a valid job in showing the tensions between the desire to create an organisational culture and the problems associated with having one. The apparent perversion of balancing personal safety against those the fire service seeks to save is identified, but the author quite wisely reminds us that other, high-risk occupations can reduce risk whilst still achieving their aims.

"Operational safety" is described as "a trade off between an appropriate and acceptable level of risk taken by firefighters to extinguish fires and rescue or protect civilians and the level of safety required to prevent firefighters from becoming casualties themselves." In making this statement, it may be implied that acceptance is given to the fact that firefighter safety and maximum effectiveness in rescues is in some way mutually exclusive. It is identified that "as conflicts arise between performance and safety, many organizations choose to take a bureaucratic approach to safety and establish rules and procedures" and, in my experience this accurately describes the approach taken by many fire and rescue services. This, to some extent, explains why organisations can manifestly display all of the

aspects of a positive safety culture and yet demonstrate behaviours that are contradictory – the true culture has been driven "underground." The elements of an effective organisational safety culture are well defined and in being so, an opportunity exists for the study to assess which aspects are clearly existent in the service already and which are seemingly not. Throughout the study, good balance is maintained between theoretical research and practical situations and this is evidenced particularly by the careful referral to the model of "reciprocal determinism."

The effects of injury to firefighters upon continued operational efficiency of fire fighting and rescue operations is noted, and this is the crux of the first business reason for change – the levels that should convince fire chiefs and city planners. The clear linkage between high firefighter casualty, and civilian casualty, rates is made, and some correlative emphasis is given, but an opportunity exists to drive down both by reducing the risk in society (by fire prevention, engineering and education) and thus demands upon firefighters, thus achieving a "circle of success." To change organisational culture, the author correctly identifies the need to "change the image of the organization and its members" thus establishing the linkage between culture, identity and image in considering how these factors influence the development of a safety culture.

"Organizational narcissism" is identified as one potential factor in the Fire Service's apparent resistance to adoption of a safety culture. It seems that other changes that are driven by modern agendas, such as diversity and fairness, may offer comparable studies. The extent to which the specific behaviours that are identified as aspects of "organizational narcissism" (denial, rationalization, attributional egotism, a sense of entitlement, and self-aggrandizement) actually exist is not established and thus could be classed as suggestive rather than factual. When discussing identity, the statement that:

> "The emotional response of members of an organisation is expected to be negative when the issue and related actions are interpreted as inconsistent with the identity of the organization and its members."

shows why there is often such resistance to change, but perhaps more fundamental is how the identity can be changed. Without changing how the service is perceived (most importantly, by its own workers), the ability to change safety culture seems to be limited.

The personal effect that working within an organisation has on workers is well linked, and identified as organizational identification, with the integration and associated attachment that develops being clearly demonstrated. The way in which individuals' values may be affected by this process is touched upon and it almost leads the reader to think of whether or not the changes that are made to an individual due to association with the organisation are reflected only in their work beliefs and behaviours or whether it is a life change. Other studies may offer the answers.

It was interesting that the need for "adaptive response" is greatly reduced, or eliminated, when "a high level of fit exists between the attributes of the organization and those of the individual members." This would appear to be self-sustaining in terms of attraction and recruitment, and to change the culture may require re-branding not only aimed at external stakeholders but also at internal workers (who are often our main source of advertising anyway). Staying with the theme of what attracts individuals, the report alludes to personal desires that are almost Maslowian in their considerations. Most employments offer the lower Maslowian needs of income to provide food and shelter, but there is a suggestion that the higher ones (self image, social status) leading to self-actualisation are associated here. This too may explain the depth of the cultural markers that require challenge. I fully agree that the social status is related (in some complicated way) to the public's perceptions of risk, but not necessarily to injury and death levels. The stories of business-class passengers giving up their seats to service personnel during large conflicts are not borne of the knowledge of the rate of death and injury that the units were sustaining, but more from a need to identify with their efforts and show support for them.

Using another military example, do the public think any less of bomb disposal experts because they sit 200 yards away in a robotic control vehicle? I think not. The value of their role is not in the risks they are willing to take but more in the (very visible) benefits they confer in society. No members of the public think less of them if none die within each year. Fire, as Stephen Pyne describes in his book, *Vestal Fire*, is deeply rooted in the human psyche and no matter how apparently civilised we become, it remains it seems our oldest friend, and oldest enemy. This may explain the different view toward firefighters than personnel in other high-risk industries.

I agreed that "The issue of safety has the potential to change the way the fire service as a profession thinks of itself and to change the way others think of the fire service," but not necessarily that "Safety has the potential to shatter the self definition of the members of fire service organizations by changing how they see themselves and how they measure their value and worth in society." I feel that this would be possible only if the change process is badly implemented or advertised **and** actual effectiveness is reduced. The likely or potential human, organisational and broader *public perception* challenges to adoption of a safety culture are clearly highlighted, but these challenges will offer the solutions that need to be addressed at the planning stage.

In order to make the change, the report suggests, firstly, introducing the elements of a safety culture and working towards their acceptance. Little mention is

made of how the inertia that is likely within the existing workforce may be overcome or diluted. I propose that, in order to change culture, organisational values and the way in which people are "adapted" by their entry into, and work within, fire services, it seems that, as well as seeking to influence behaviours and values, it is vital to actually change the type of people (through new employment standards and selection processes) who work in the service and the way in which it is managed (management styles, punitive and reward mechanisms).

Whilst I accept that the scope of the study was confined to "cultural" issues, the best results are sure to be achieved by changing how we deal with our operational responses to fires and other emergencies. Fire and Rescue Services must also contribute to those programmes which drive down the likelihood of such emergencies occurring. Without campaigning for higher-level risk reduction measures, our successes will be limited due to the fact that the same innate risks will exist in society. To effectively lower risk permanently, engineering the societal risks is required. In the UK for example, dramatic public and firefighter safety advances were made when the government banned polyurethane foam-filled furniture in the late 1980s. Similarly, the building standards were amended in the early 1990s to make smoke detectors that were "hard wired" mandatory in all new and upgraded premises.

The statistics that indicate the actual injuries and deaths of firefighters may have a simple explanation that needs to be excluded (or compared against). Hypothetically, what if the actual risk to firefighters was increasing due to more fire emergencies, more toxically combustible fittings and furnishings and rising socially related risk factors such as alcoholism and drug use? This would also account for rising statistical failure and even accounting for better equipment and safety practices, higher rates of injury may result. The conclusion that "The development of a safety culture in the U.S. fire service will be a difficult transformation" seems an understatement given the challenges identified. The risks associated with making the changes are clear, and a marketing strategy that convinces the public and politicians will be required.

In conclusion, I found the study highly stimulating and informative. It will inform the implementation of the safety culture that seems vital at this time.

Paper #2: "Getting to the Heart of the Matter: Reducing Firefighter Line of Duty Deaths," by Walter Malo and John DeIorio

The report sets out the reliability of the data sources and, despite their being comparatively small number in statistical terms, validates their reliability with reference to their consistency and correlation across several recording methods. This establishes the statistical basis as reliable for usage.

In considering this issue I feel that the authors could further (as they actually did during their conference presentation) address the fundamental question – 'Is a cardiac arrest during Fire Service duties an on-duty death?' There are also categorisation issues. It may also be relevant to seek to breakdown how many of these deaths and illnesses are attributable to the specific activities required of the role dictated by their service duties, rather than them simply having occurred contemporaneously with being at work or, as noted by the USFA recording mechanism, being employed by a fire department. For the purposes of meaningful comparison, some *benchmarking* would add value (e.g. how many other employments are held accountable for "at work deaths" in this way)? Does fire fighting, in comparison to similar employment profile groups (e.g. police officers), seemingly present higher risks of cardiac arrest or illness? Value will be added by introducing the "control" comparators of cardiac illness rates with general groups such as 'similar aged males' etc. In essence, the difference in risks of illness presented by fire service employment/activities is key in assessing whether the possible solutions may lie within the fire service's gift. If the risk is high for example, but no higher than that of society (locally) generally, notwithstanding that fire departments have a significant role to play as responsible public employers, the best and most cost-effective remedies may be more generic in nature.

It is noted that other related departmental policies, such as the death rewards for firefighters may have a "masking" effect upon diligent categorisation. The "Heroic" status of fallen comrades is also a strong inertial influence. The study makes good use of the overall statistics available on deaths, and despite my acceptance of their reliability for what they are, further validation of trend could be achieved by assessing the (much larger) data sets from injury and ill-health from cardiac failure.

The article makes valid and interesting note of the adoption, and adherence to, the NFPA standards for occupational health programmes, although causal correlation is not established between this apparent non-uptake and poor performance. A natural extension of this research, and potentially a further study, is an investigation of why, when seeking to encourage those fire services that do not currently use the NFPA Standard for medical programmes, few apparent incentives, legislative or political 'levers' are apparent. Cost/ benefit analyses are seductive but, without the 'cost' of a lost or disabled firefighter falling on that service, is likely to be a weak argument. If the studies are available that actually measure the employer costs of such events (as insurers use for workplace accidents), they may help inform these further studies. In any case, such an argument would require accurate and reliable "cost" data in order to be presentable. This may prove challenging in the Fire Service, where all *personal* costs of human loss by our staff is traditionally offset against the

societal benefits they confer by their actions, however unquantified these benefits may appear to be.

In establishing Medical Standards for any employment, it is important to ensure that they are based upon *genuine occupational requirements*. It must also be recognised that there are significant differences between medical standards and physical standards. If standards are not based on the genuine occupational requirements, they will almost certainly be unfairly discriminatory in some way and may be subjected to successful challenge.

I agree with the authors' contention that education of medical practitioners will assist, and the budgetary restraints that are apparently a barrier to more fire chiefs demanding better medical support should be offset against the financial losses sustained by ill-health or death of an employee.

One method that was not highlighted by the study is to make senior management personally accountable for failings in occupational health schemes. Employing staff that are at risk of cardiac failure due to their personal indicators or presiding over working practices that contribute to worsening health are at best poor leadership and could be construed as culpable. The punitive nature of criminal (corporate or personal) or civil litigation is also a powerful device. I indicated during my verbal feedback at the conference that historically, examples of direct accountability abound and the results can be dramatic. The evidence of improved ownership at senior level from profit sharing is manifest – a rewards mechanism that rewarded improving staff health may be productive. Whatever method of improvement is selected, it is certain that a "top-down" driven approach will be vital to ensure success.

A really alarming concern was the identification within the study of the syndrome in which firefighters with no previous detected illness or indicators suffer serious cardiac failure. This may act as a "Clarion Call" for the study and, in that it will be meaningful for all fire departments regardless of the efficacy of their Occupational Health arrangements, should interest all stakeholders equally. A suggestion emerges of inadequate screening and, even in those cases where screening was conducted, an inadequate awareness in medical practitioners of the requirements of the employment. The physical (and somewhat unique) nature of the emergency role of firefighters is well defined and referenced, but some counter considerations would have allowed the arguments to develop. For example, did those studies that identified the physical stresses upon firefighters use "controls," if not, the fact that the study group were firefighters could actually have contributed to biasing the results. One of the potential controls is made apparent here by the authors -- reduction of the physical demand by changing the role!

The study uses good exemplars when showing how cardiac illness and obesity have contributed to the deaths of certain individuals, but this in itself does not prove any arguments. A counter debate could be indicated, for example, by those firefighters who are obese and have not died on duty, which is sure to be a higher figure.

A key question to which the report leads us is: What can be done to reduce stresses? Further study is needed in the areas of working practices; including preventative measures such lighter equipment, less thermally restrictive clothing, less alarming alarms on fire stations. In seeking the higher level, engineered risk reduction measures, we must always start at the top with elimination of risk. The impacts of safer communities due to education and fire engineering, leading to fewer emergency calls (or at least less developed fires due to better and safer construction) all leads to lowering societal risk and thus the physical demands upon firefighters. However unpopular this approach may be with fire crews, it is the only sensible economic and sustainable method of risk reduction across all fire service activities.

The reference to 'known' heart conditions is made in the report and it begs the question – to whom? If the condition was known to the firefighter and undeclared to the fire department, the ability to control the risk is limited. In any case, the report could be more explanatory about what categorising what "known" means in this context. One main implication of the study is that the absence of effective health screening directly contributes to failings such as these. This is a very valuable outcome of the research. The identified fact that most chiefs would return firefighters to active duty after cardiac illness and even surgery is established by the survey and, to some extent, this may be indicative of their inability to fairly discriminate due to the absence of evidence such as the survey has produced. The suggestion, that more education for physicians and medical advisors is seemingly required, is well made.

The suggestion that pre-employment medical examinations and established medical standards should be normal practice is sound, and is clearly founded in the evidence of the research. A more effective way of presenting them, when implementation is desired, may be to indicate that these are simply good business for any employer.

In proposing the introduction of newer, more stringent standards, the study may wish to tentatively explore, or at least recognise, (in the spirit of applied research) the inertial challenges to effectively doing so. These may include:

1. Resistance from existing staff due to new entrants being 'seen as better.'
2. Deterrence to applications in small town, with volunteer communities.

Some of the key factors that seem to be related to the development of cardiac illness may be incorporated into all departmental regimes:

1. Selection may wish to consider: Applicant's lifestyle, recreational and smoking habits, and family medical histories. In a service that apparently has a tendency to unacceptably high cardiac failure levels, there are strong business arguments for not selecting from the families and peers groups of the existing staff, who may be predisposed by heredity. Whilst seemingly controversial, this statement is worthy of test.
2. Dietary Regimes are somewhat under the influence of fire departments. They can influence the size and content of meals and, in the interests of better business, should be taking active measures to promote healthier eating among staff.
3. Exercise Regimes are potentially a method of *sowing the seeds* of a healthier lifestyle for fire department staff.

It struck me that, given the status of firefighters within our communities, an opportunity exists for this work to be advanced with firefighters being exemplars of health improvement initiatives within our communities and perhaps partnership with local community health organisations is the best way to bring forward this agenda.

In summary, the study set out to answer three questions. First, do firefighter candidates and incumbent firefighters receive proper physicals and fit-for-duty assessments in accordance with NFPA 1582 prior to beginning training or continuing employment? I feel that the report did a good job of establishing that, generally, the NFPA standard is not adopted, and rather than "proper" physical examinations, as suggested by this research question, the "adequacy" of these examinations is called into doubt.

The second question explored was do active paid and volunteer firefighters participate in ongoing job-related physical fitness throughout the course of their career? In addressing this research question, the authors make reference to age factors such as the increasing likelihood of being over 50 or over 60. Coupling these facts (which, in future research would need to be benchmarked against society in general or other occupations) with the identification of firefighters as "occupational athletes," would seemingly suggest age discrimination, or perhaps more appropriately, more detailed medical screening for aging workers, as a control measure. The suggestion that physical fitness regimes will improve matters is well supported by evidence, but cannot be brought forward in isolation. Simply engaging the existing workforce (with all of its apparent existing cardiac ailments) in more physical activity may be counterproductive.

The third question posed was, Are active paid and volunteer firefighters educated in the benefits of, and strongly encouraged to follow, a healthy diet both on-duty and off-duty? Again, this question is answered, but regrettably it seems that the answer is a resounding no. Without the benchmarking against similar non-fire service population groups, however, it is difficult to know if the noted increases in body mass and associated ill health are specific to the fire community.

In seeking to encourage employers to recommend healthy eating, it must be recognised that the role of employers (as is the case for schools in addressing childhood obesity) is limited. A larger influence will be the individual's lifestyle choices and, unless they are failing to perform against a number of accepted and approved role-related criteria, could be construed as "none of the employer's business." In noting the natural peer resistance to healthy lifestyles, one possible method that emerged in my reading was the adoption of better and active role modeling by fire departments. In closing, a very useful and deeply effective piece of research which, as all good research does, answers its own questions whilst posing many others.

Paper #3: "Applying Good Health and Safety Management at Operational Incidents: A Dilemma?" by Andrew Strawson

In my verbal feedback at RE06, I indicated that this report was "walking on my grass" and I found it stimulating, and thought provoking. The author achieved a blend of situational anecdote and legislative explanation, which gives a flavour of the current challenges. When studying events that have caused unsafe acts or injury, one often finds that the actions that were taken were known by all taking them to be wrong and dangerous and, sometimes, they have done so in the belief that the public would have expected them to! The report supports this view by stating: "There is a high level of public expectation that firefighters both can and will respond to almost any demand put upon them."

It is unmeasured the extent to which societal expectations, and the associated moral pressures, act in making our staff work without safe systems of work. It is often said that, when taking risk on the fireground, "If it works – we give a commendation, if not – we will be prosecuted." Yet I can think of circumstances in which I would commend the actions of brave firefighters whilst seeking to re-train their leaders for failing to put in place suitable control measures. These are not mutually exclusive.

The fact that Fire Services were subjected to "normal" application of safety law was traumatic for many leaders. The loss of their 'special status,' as many saw it, in the early 1990s had significant consequences and, in my view, was contributory to the risk aversion that now exists. It should be noted that no exemptions existed.

In considering the fire and rescue service in a safety context, we must recognise that the UK's fire services work within a highly politicised environment. In the UK public sector 'risk' aversion is rife – not only in safety. Several reports into modernising the Fire and Rescue Service in the UK refer to risk aversion and the industrial history bears some responsibility for this situation.

The Fire Brigade's Union (the largest representative body for firefighters) is very active and powerful. Whilst it generally acts in good faith, safety is often used as a weapon with which to criticise and influence managerial agendas (because it has such strong legislative back-up systems) much in the same way as "race" is currently becoming vogue for the same purposes.

The way in which risk is envisaged is also of great relevance in the UK Fire Sector. The term "risk" has been overzealously (and often wrongly) interpreted by many as something that is entirely unacceptable. I am seen as a "champion of diversity" and I find similar misuse of the term "discrimination." I was recently accused of having established selection processes that were discriminatory. I was a little confused because the entire purpose of selection processes is to perform subjective and job-related discrimination. Essentially, all fire service stakeholders need to be educated to understand that risk is not bad – but that unidentified or unmanaged risk may be.

I agree with the author in respect of the "anecdotal views" that "health and safety is preventing them from doing the job of safeguarding the communities they serve." I often hear this from fire fighters and managers alike. I have some difficulty in explaining to them that it is not meant to do so. It is supposed to make them more effective and safe whilst serving our communities. It seems however that clumsy and crude control measures that have been put in place (seemingly in attempts to make risk disappear altogether) have given the appearance to fire crews that their safe systems of work are barriers to effective working. These are not failings of Health and Safety – they are due to poor managerial understanding of the intention, and operation, of safety regimes.

It is important also to recognise where one "control" agenda can affect another. Most services that introduced fitness testing recognised their responsibilities to allow staff to engage in physical exercise whist at work. The "at work" injury rate from sports activities is often comparatively high. Do fire service employers then tolerate this injury rate and seek to lower it by cautious management of physical training, or do they ban these activities at work and allow aerobic capacities to fall? One is a moral argument in favour of healthier workers who live longer, but the other (given our comparative low age of retirement) finds favour with pure business logic. Will the falling aerobic capacity affect the individual whilst they are still working as a firefighter? In most cases, probably not. Other policy changes are related – the recent change in pension law (effectively ensuring that, in future, firefighters may serve to age 65) is sure to have an effect upon both physical fitness of firefighters and the age profile of services.

The RIDDOR statistics referred to in respect of reliability of statistics – Fire Service "over 3 day" statistics -- have traditionally been influenced by a litigious "claim culture" and also a presumption by family doctors (GP'S) that all firefighters have to be fully fit for all duties, all of the time, when at work. Numerous anecdotes abound of firefighters who are perfectly capable of performing 95 percent of their normal role but are certified as unfit for fire service duties by well-meaning GP's. In caution, I would offer that, whilst the statistics can be taken as reliable in the UK for police and fire because they get paid when off sick, this situation may not be true of all sectors and this may have the effect of masking the true figures, making public sector bodies appear to have poorer safety performances. The unusual (but not unique) nature of having a workplace that is (at least as far as emergencies are concerned) relatively unpredictable is noted, as is the fact that firefighters may not be removed from the hazards presented by their attendance at emergency incidents.

The statement that "Personal protective equipment (PPE), which in most cases is used when a range of other control measures have already been implemented, is often the front-line defence for the fire and rescue service" is somewhat unfair in my experience. Modern fire service leaders are coming to understand that PPE is a last line of defence that mitigates damage when the safety systems have failed. The proposed cost/benefit analysis is enshrined in the Incident Command System, in which the intention could be described as: "We will risk our lives in a controlled and measured fashion to save the lives of others, where the chances of success are high and the risks controllable, but we will not knowingly risk lives for any purpose other than to save the lives of others."

In considering "whether the immediate needs and pressures of operational incidents are in conflict with the implementation of good health and safety management techniques for the fire and rescue service," the answer is seemingly a "straight yes," and yet all of my experiences have taught me that this is not true. This study is valuable to fire service leaders in that it shows that risk and effective working are not mutually exclusive – they may in fact be complementary.

A key point is made when it is noted that, in respect of the benefits derived from taking risks to save lives: "the risks are not faced by those who get the benefits." This will present a real challenge in seeking behavioural changes. From experience, I am not sure that the first dilemma actually exists; it may apparently exist to those of us who scrutinise, or oversee, the working of firefighters. This manifests itself when we ask why certain operational activities were not done – the answer is often that it could not be done because of Health and Safety. It seems that workers have noted the effectiveness with which Health and Safety is utilised as bargaining tool by representative organisations and recognised that it serves as a useful defence on occasions.

The second dilemma (or perhaps a paradox) is clear and it must seem strange to outsiders how systems that are so "over-prescriptive and even bureaucratic" can be followed by actions in which "instant responses take over without adequate consideration of the way the in-

cident should best be handled." The conflict of dynamic decision making is well explored by various authors and the pressures acting upon individuals are considerable. Another dynamic is that, at some time, the "moral righteousness" on H&S matters shifted to the Fire Brigades Union (FBU). The FBU does a great job in the main of assisting employers in establishing safe working practices, but due to industrial disharmony, strategic moves have taken place that are intent on diminishing their influence within the service. Some managers have taken this to mean on all matters, and are not as engaged with them on "normal" safety business as they could be. The fear of litigation (and prosecution) seems to be a powerful driver for senior public sector managers, and they may have been another influence in creating and sustaining the overly prescriptive and bureaucratic systems that are noted.

The example given of a ruling that "society expected emergency service workers to put themselves at risk in the course of their work," could be countered, however, with hundreds each year that appear to indicate otherwise. The "litmus test" seems to be that, if someone got hurt, the service could not have had an effective health and safety management systems in place. Even in those circumstances in which firefighters do something without the instructions of the employers, endangering themselves and others, no legal cases have been brought as it would not be seen as serving the public interest. When it is considered that, in these circumstances, internal discipline (as would be utilised in most other employments) is not an option (in that it may dissuade others from performing any roles without those that are strictly prescribed) the employer's difficulties can be more understood.

I was impressed by the understanding that: "while the general rule is to go away from hazards, the emergency services have to go into hazardous situations," which accurately encapsulates the innate conflict in managing safety at emergency incidents. Dealing with the comments in the report, I offer the control devices that are intended to be used:

- Lack of choice over where they have to work. The idea of controlling this risk is that, if we cannot make the place safe, we will make our workers more aware and safer – The SAFE PERSON CONCEPT.
- Inadequate information about the nature and extent of the hazards that are present. In encouraging our front-line managers to recognise the fluid nature of incoming information, and their need to revise plans accordingly, the concept of DYNAMIC RISK ASSESSMENT is used.
- Unpredictability of the range of hazards creates a set of circumstances which, whilst not routine, may be categorised within a range of generic response types. For this reason, the concept of GENERIC RISK ASSESSMENTS was introduced, supported by a range of simple guidance handbooks and supporting information systems.
- The changing role of the fire and rescue service does present new risks, but if the skills and competencies of fire managers are adequate, they will recognise what is and what is not within their safe working capacities. The only risk to that process is a strategic change to the work activities coming about by central directive (such as the new terrorism preparations) without taking cognisance of the effects upon preparedness for "normal business."

The research findings in respect of the public expectation of firefighter "sacrifice" are interesting and it would be valuable to know why they remain unpublished.
I fully agree that the "culture of the fire and rescue service may need to shift to provide the right balance between over-prescriptive, inflexible, rules and not responding adequately to the risks undoubtedly present at operational incidents" but the key question is – where will this process start? Will it be by advice to the judiciary on sentencing, directive to enforcers such as the HSE, advice to employers or by public announcement? In truth, none of these seems feasible or likely. True culture change is not something that is announced and implemented – it is something that comes about silently and effectively. That is not to say it is unplanned - just unheralded.

I found the use of comparative case studies appropriate and convincing, and the statement that "employers should not make untested assumptions about the competence of employees to deal with emergency situations" was synergetic with my own experiences and views. An assumption is often made by fire service managers and worker groups that training is a panacea and that if it has not been provided recently, a failing is sure to happen. This is due to a tendency to imagine training lowers risk without assessing: need first, and effectiveness of development programmes second.

Measurement of existing capacities and capabilities is, in any case, an essential element of efficient training regimes on the grounds of good value. The definition of competence is valid and I offer my views on the fire service's approach to achieving it. Since the inception of a new training and development model, a tendency has emerged to target competence as an end goal. I often ask firefighters how many carpenters they know – they reply "dozens." I then ask how many of those they would want to fit their new kitchen. The answer is only "one or two." The difference is due to the gap between competence and excellence and I worry that the fire and rescue service targets competence instead of excellence. In targeting excellence, if the target is not achieved, competence is a certain achievement on the voyage towards excellence. If we fall short of competence (because it has become the target), incompetence is the result.

I was pleased to note the view that, with regards to realistic training, "The enhanced risk, albeit in a

controlled manner, of realistic training is balanced by the higher level of competence and confidence in the real-time incident." This would closely mirror my own approach and, whilst not in any way seeking to reduce the need to perform realistic and meaningful risk control measures, would more closely relate to the actual emergency tasks that people are asked to perform. For crew managers for example, they could also develop further their Dynamic Risk Assessment Skills if they revised training pre-assessments whilst actually undertaking training exercises.

I agree with the conclusion that "There is no simple answer to the dilemma" and feel that the service should do more to advertise the positive engagements it has with the HSE. One of the reasons that the HSE has to rely upon trade unions for information is that employers are the ones who are seemingly going to be the *victims* of any enforcement action and the unions can inform or misinform the HSE without a care.

Paper #4: "Issues Involving the Safe Operation of Fire Department Tankers," by Mike Wieder and Kevin Roche

This report highlighted some worrying statistics and certainly provided "food for thought." The "death and injury" statistics referred to may need some caution. To what extent is a true reporting culture in evidence? I always advocate that deaths are certainly correct statistics (somewhat obviously) but that, due to the divine nature of the difference between death and serious injury, the real measurement is the number of occasions in which the event had the potential to cause harm occurred is more valid. As noted by the authors, of course, these may be almost impossible to measure accurately, given our cultural barriers. In verifying the apparent validity of the statistics, it may be firstly required to establish their veracity or completeness. The authors do note that they are the best available, but when selecting national strategies for risk reduction, the foundations must be reliable. Essentially, is the scale of the problem as it seems? What verification of the statistics is undertaken by the sources? One potential method of validation may be to benchmark the fire service's "strike rate" against:

- All user RTA statistics
- All tanker vehicle accidents

The ratios derived would at least indicate if the problem is endemic or simply a fire service one.

Often, when analysing whether a control mechanism can be affected in a risk-reduction system, it is necessary to ask ourselves – is this event within the control of the employing agent? By breaking down each activity in the causal chain, the authors give readers the opportunity to assess each in isolation and identify single control measures.

When crew members are alerted, their conduct in proceeding to the station house is clearly within the control of the fire department. It can never be acceptable that firefighters endanger other road users in their attempt to deliver public safety services; this would be entirely paradoxical. Firstly, fire departments could set standards for their crew members, they could back this up with some community education on what they may expect in terms of station responses and, as a final control measure, they could support a strong staff instruction by sharing it with the local law enforcement agency so that they will know what the fire department feels is acceptable (and unacceptable) in terms of responding to alerts.

It would enhance the reader's understanding of the report if the driving standards that are required by fire departments were referred to. It is accepted that this may be very variable and may require some other study to fully establish the true position. To comprehend the actual position as stated took some prior knowledge and understanding of the U.S. fire community. Are the drivers of fire emergency vehicles assessed in any way other than a standard trucker's licence? Do they enjoy legislative exemption (or at least judicial leniency) whilst underway to emergencies, what would constitute an emergency? Insurer pressure may be able to drive (no pun intended) changes in this area.

I am convinced that, to make permanent and reliable change in any safety management system, engineered controls work best. These tankers are not saving lives; they are delivering water to large wildfires mainly. If they are saving lives at any frequency, the fire department in question should be reviewing its risk management planning. Do visible and audible warning devices have to be fitted? Why would we wish them to proceed at increased rates of speed in emergency driving conditions? The journey's purpose must be analysed. It is also true (and not unusual) that the engines of large vehicles can be 'governed' or mechanically geared to limit or govern speeds. The purpose of a journey is also relevant when considering control measures. Are support vehicles such as incident command units and water tankers travelling to save lives? Are fire captains and chiefs in their cars saving lives or even firefighters responding to stations? If not, why would we wish for them to break normal road laws and present a hazard to other road users and who will be liable when they do?

The findings concerning time of crashes was surprising to me and warrants more investigation. As in most countries, the study showed that most fires are evening, but also noted "the frame of noon through 6:00 pm accounted for 55% of the fatal tanker crashes," which was consistent with other studies of fire apparatus and other emergency vehicle crashes. The possibilities as to why this may be the case, but insurers data on all collisions may make useful comparisons.

Another factor that is clearly within the gift of each fire department is the abilities and competencies of its drivers. After carefully selecting who may drive fire trucks, based on experience, aptitude and previous driving histories, one effective device that can be used is to establish and maintain clear Emergency Fire Appliance Driving standards (EFAD). Recognising that normal truck driving qualifications and experiences did not equate well enough to emergency driving situations, the UK's fire services introduced EFAD standards over 15 years ago. This has now mutated into Response Driving Training in many services, and incorporates training in high speed driving, assessments of capability, and anticipation of the behaviours of other road users. This is undertaken at regular periods for fire appliance drivers. The results have been good and collisions and accidents are thankfully rare and generally do not result in deaths.

Due to the statistical findings, I understand how seatbelts come to be incorporated as a simple safety measure, but there is a danger of treating a symptom rather than the disease. The use of seatbelts, whilst seemingly certain to reduce the severity of the outcomes of crashes to fire vehicle occupants, are not in my opinion a preventative measure. They are a mitigating influence once the accident occurs, but the accident has to occur before seatbelts can be deemed effective. This renders them therefore a "last line of defence" and their increased installation and utilisation, whilst important and laudable, will not, for example, reduce risk to other road users.

The article highlights the frequency with which fatal crashes involve water tankers and the relevance of the number of movements in the volunteer sector is not measured. Whilst it is not possible to argue with the direct logic that a volunteer fire call requires more vehicular movements than a career crew "turning out," it is equally true, by their very nature, that the career crew will be travelling in much more built up areas, with a greater number of road users and a higher potential for collision due to these facts. This would need to be eliminated or benchmarked against. Could it be for example that the higher levels of driving experience, or training opportunities explain the differences? Or is it simply that fewer career departments have tankers in their fleet? This figure too would be a useful denominator. In seeking higher levels of control, the best (or most effective) solution may be going 'above the problem.' The considerations in attempting to lower risks, in this context, may be able to start with an assessment of:

1. Tanker necessity: How vital is the vehicle? Is there another way, such as the creation of static supplies in high-risk areas? Could fire fighting methods be adapted to accommodate the use of less water? Do fire departments want to lower costs by not having tankers in the fleet?
2. Tanker location and likely locus of usage: If tankers are required, let us consider where to locate them. In establishing the need to have them, their likely places of use must have been self-evident (or could simply be calculated utilising historical data). Once the routes that they will be travelling are known, an analysis of which ones have *high collision rates* should be possible and risk reduction measures selected. Generally, if we have to respond in tankers, what control mechanisms can be put in place to limit the likelihood of the risks becoming a hazard?

The article makes mention, but no detailed study, of the risks to other road users but this should provide key leverages in trying to enforce change. It must never be acceptable to endanger innocent road users for the purposes of trying to extinguish fires. Fire chiefs, and police chiefs, must say so loudly so that communities will understand their positions. What do we think the public would make of the figure that "3% of the vehicles are responsible for 22% of the response deaths"? Can we imagine that they would find this situation acceptable? Do our insurers know?

The starting point for all hierarchies of control is elimination of risk. To be able to do so effectively, the true root causes must be identified. Comparable studies between apparently good and poor performing fire services can assist. In Scotland, some years ago, I identified that two fire services of very similar size, risk profile and demand, had "Blue light" accident records that were so different that one was five times more likely to have a collision that the other. The differences between the two services were no more than their approaches and attitudes to driver training and managerial acceptance. In essence – each Fire Department has to know how bad or good it is in this respect. They may feel that their performance is normal – without comparators and benchmarks, it may appear to be.

In seeking solutions, the comparison with other tankers users (e.g., chemical and oil transporters) may assist with vehicular design issues, driver qualifications and other risk-reduction methodologies. We must establish whether our selection, training and qualification requirements are similar to other road tanker users. The answers to these questions may explain any significant statistical differences. This would seem to be a complementary study to the one in question.

One simple improvement measure identified by the study is that the windows of these vehicles being open presents added hazard. It is tempting to simply advise that windows must be kept closed so that the risk of ejection in collisions will be reduced. How likely is this rule to be followed? Human factors are important, and instructions such as these are not generally followed because the driver does not think that a crash is likely (because it generally is not). In order for this to be developed into a control measure, we must ask ourselves, "what would make them keep the windows closed?" For example, imagine if we said something like "All vehicles

will be specified in the future so that windows cannot be opened to protect the hearing of fire crews from the audible warning devices." This may be a far more effective approach.

The study made little mention of the effects of alcohol or recreational drugs. Were they a feature in any investigations? It would be helpful to at least indicate that they were not a consideration.

The study notes "the fact that volunteer firefighters accounted for all of the crashes and fatalities during this study should not be a surprise and is not an indictment of volunteers. The primary factor is that volunteers generally protect rural areas where tankers are needed. Road conditions in the areas protected by volunteers also tend to be more challenging (more hills, sharp turns, poor road conditions) than those in areas protected by career firefighters. Therefore, it is only natural that volunteers would account for most crashes involving tankers." As stated, this statement may not be justifiable without the reassurance of knowing that volunteers are trained and assessed in their driving skills to the same standard as their career counterparts.

The assertion that there exists a causal relationship between driver age and the likelihood of a serious tanker crash was validated by comparison with insurance industry actuary rates for correlating age and crash frequency, which seems to give good support. The presented "factors contributing" table is useful, but the identification of the true causes of the accident itself is more relevant when seeking solutions. The facts that (1) the apparatus wheels leaving the right side of the road; (2) excessive speed; (3) overcorrection/oversteering by the driver when attempting to bring right wheels back onto the road surface; and (4) failure to negotiate a curve are the key causative factors, indicate driver competence as an issue. The later finding that "poor apparatus design or poor mechanical condition of the apparatus as causes for the collisions" is not notably indicated seems to be confirmative of this suspicion.

It struck me that the *key control measures were identified from the first analysis of the results*: "If firefighters wear their seatbelts, operate the vehicle at a reasonable speed, and keep the wheels on the driving surface" there would be far fewer fatal collisions. As I have explained, I see these in reverse order when we are considering the hierarchy of risk control.

The use of case histories is well explained and justified to readers -- "to show the reader that the noted causal factors have previously resulted in a tragic outcome," and is well delivered in this context. The simplistic facts that are derived from the first analysis are verified and exemplified here, but more complex solutions are also indicated (tacitly). Driver training and assessment emerges as desirable, managerial acceptance of their role in controlling the actions of their drivers is implied, the fact that fast speeds to low life risk incidents is common is identified,

In order to ensure the validity of the information contained in this report, the USFA convened an esteemed group of subject matter experts who served as peer reviewers for the report. Notably all were related in some way to the fire industry. It strikes me that an opportunity exists to learn from other industry sectors and perhaps inviting representatives of other tanker industries would have added value.

The 20 items identified by the working group are great, and I have classified some, and added one or two comments that may assist with their "implementability."

1. Operate the tanker at a safe and reasonable speed. (Training and Departmental Standards)

Comment: Are there fire conditions that are not strictly emergencies? A bush or wildland fire, for which tankers are often despatched, are not life threatening so why the haste?

2. The cautionary speed signs that accompany road signs indicating curves in the road should be considered the maximum speed for a tanker driving on these curves in any condition. (Training and Driver Education)
3. It is recommended that new tankers exceeding a GVWR of 32,000 pounds be equipped with antilock braking systems. (Departmental Technical Specifications)
4. Keep all of the wheels on the primary road surface at all times. (Training and Driver Education)
5. Travel with the water tank either completely empty or completely full. (Training and Departmental Standards)
6. Avoid operating retrofit tankers if at all possible. (Departmental Technical Specifications)
7. Know the weight of your apparatus. (Training and Driver Education)
8. Require mandatory training for tanker drivers. (Training and Departmental Standards)
9. Establish an effective maintenance program for the tanker and all other fire department vehicles. (Management and Departmental Standards)
10. Use spotters when backing the apparatus (Training, Departmental Standards and Driver Education)
11. Retrofit all tankers with back-up alarms. (Departmental Technical Specifications)
12. Come to a complete stop at all intersections containing a stop sign or red traffic light in your direction of travel. (Training and Driver Education)
13. Wear your seatbelt whenever the apparatus is in motion. (Training and Driver Education)

14. Keep the windows rolled up. (Training and Driver Education)
15. Be familiar with your response district and the roads within it. (Good Firemanship)
16. Avoid poorly constructed or unpaved roads whenever possible. (Good drivership)
17. Limit the number of apparatus responding to an emergency to a reasonable, prudent number. (Simple management control)
18. Do not respond at an emergency rate (Code 3) when no emergency is known to exist. "Nonemergency rate" may need to be further defined. (Training, Departmental Standards and Driver Education)
19. Always have at least one firefighter accompany the driver of the tanker.
20. Practice driving the tanker in adverse road conditions. (Training)

I was delighted that the authors reached the same conclusions that I did from the study – that training and departmental standards are the key. Management commitment is also vital to success, if the fact that accidents (those due to not following procedures or safe working practices) are unacceptable and will not be tolerated is not emphasised, all efforts may be wasted. Efforts by senior managers, complemented by vehicular insurers are likely to be powerful levels for change.

This very focussed study "shines a light" on one element of a particular and high profile problem. In closing, it may be a useful calculation some time to offset the numbers of people saved by the fire service each year against the number killed and seriously injured by their driving actions. In making a comparison to safe gun handling, I recall a line from poem my father used to recite to us when we were young and going out shooting: "…all the pheasants ever bred are not worth the life of one man dead." If recreational sportsmen were killing as many people as fire departments do each year by actions that were clearly within their control, would there be an outcry?

Notes

[1] *Successful health and safety management*, HSE 2003
http://www.hsebooks.com/Books/product/product.asp?catalog_name=HSEBooks&product_id=2931&cookie%5Ftest=1.
[2] NFPA 1582, *Standard on Comprehensive Occupational Medical Program for Fire Department*.

About The Author

Mark Stewart Jones is originally from the Moray Area of Northern Scotland. He enjoyed a range of occupations before joining Grampian Fire Brigade in 1985. He served in a number of operational firefighting and command roles in the City of Aberdeen and was seconded to the Scottish Fire Service Training School as an instructor in 1989. Upon his return to Grampian, he advanced through the service in a number of roles, taking particular interest in corporate Health and Safety, Staff Development and Operational Command. Mark was seconded to Her Majesty's Fire Service Inspectorate for Scotland in 2001, assuming overall responsibility for Training, Human Resources, Equality and Health and Safety. In performing that role, he forged good working partnerships with the Health and Safety Executive and the Commission for Racial Equality. Mark is one of the "panel of experts" of the Global Wildfire network, which works under the banner of the United Nations (International Strategy for Disaster Reduction), and undertakes a number of representative roles. Following two years of successfully representing Scotland's interest at the CTIF (International Firefighters Association) Forest Fires Commission, he was appointed as chair of that commission in July 2005 and is influential in global fire policy making in this capacity. Mark holds a Masters Degree in management, is a Graduate of the Common Purpose Matrix programme, and is a keen Rotarian. He is married to Gwen and, between them, they have 4 children and one Granddaughter. They enjoy traveling and musical theatre. Mark was appointed Deputy Chief Fire Officer of Essex County Fire and Rescue Service in 2005 (and also Deputy Chief Executive in 2006). As well as being one of the Directors of the Service's private trading wing, he oversees the work of 7 Directors. Mark can be contacted at: **mark.jones@essex-fire.gov.uk.**

Chief Dennis Compton, Fire Protection Publications and International Fire Service Training Association Service

Observations

Paper #1: "Getting to the Hart of the Matter – Reducing Firefighter Line of Duty Deaths," by John Delorio and Walter Malo

Authors John DeIorio and Walter Malo explored cardiac-related problems and their impact on Firefighter Line of Duty Deaths historically. They conclude that Firefighters should be required to participate in pre-employment and ongoing evaluations to test their fitness for duty. They also suggest that a lack of leadership and the need for cultural change are root problems within the fire service that must be addressed.

My observations concerning this work include:

1. The authors should address the issue of hydration for personnel working at the scenes of emergency incidents and training exercises. Providing more training to fire department members (including commanders) on this issue and stressing the importance of rehabilitation services at these scenes could be critical in reducing cardiac-related line of duty deaths and injuries.
2. The paper seemed to somewhat stereotype fire departments and their leaders as ineffective in the area of medical management and offered examples to justify this position. Actually, there are many fire departments (career and volunteer) that have implemented extensive health and wellness programs with an emphasis on cardiac issues. The paper could have included examples of these programs and the management components that make them successful. This would provide a balance within the paper between negative criticism and instructive direction for improvement.

Paper #2: "Safety Issues Associated with Operating Fire Department Tankers/Tenders." by Mike Wieder and Kevin Roche

Authors Mike Wieder and Kevin Roche researched and gathered data that indicates that Tanker/Tender-related incidents result in an inordinate percentage of total fire apparatus crashes and firefighter fatalities and injuries that result from those crashes. The authors clearly show that if firefighters wear seatbelts, operate vehicles at a reasonable speed, and keep their wheels on the driving surface they likely will not be involved in fatal collisions.

My observations concerning this work include:

1. It would be beneficial to research specifically which states have enacted statues that limit the emergency response modes of apparatus. A comparison of that data could be made to the incidents of collisions involving fire apparatus, especially tankers/tenders.
2. Many fire departments have implemented training programs and driving regulations that certify and direct operators of fire apparatus. It might be beneficial to research whether such certifications and/or regulations existed in fire departments that experienced fatal collisions (especially involving tanker/tenders) and whether the operators involved were following the regulations at the time of the collisions.

Paper #3: "Developing a Safety Culture in the Fire Service." by Author William L. Pessemier

Author William L. Pessemier described concepts associated with a safety culture in the fire service and made recommendations for creating a more desirable safety culture. He also related the fire service safety culture to such factors as organizational identity, self identity, and adaptive response. The author relates that an optimal safety culture maximizes the effectiveness of available resources within reasonable and acceptable limits of risk.

My observations concerning this work include:

1. The author suggests that safety is not just about the number of firefighters riding on a fire truck, and I would agree that the number of firefighters who respond is not the sole measure of safety. However, policymakers in many jurisdictions routinely dispatch inadequate numbers of firefighters to emergency scenes, knowing full well that they will be pressured (externally and internally) to accept and take risks that significantly jeopardize their safety and place them in a noncompliance mode with existing regulations and standards. This creates an inherently unsafe work environment and impacts the safety of firefighters and the survivability of customers.
2. Perhaps the most powerful motivator we have as leaders is what we decide to hold up to others as examples of exceptional performance and behavior. This can be as (or more) successful in creating change as punishment for the noncompliant acts that we catch in the system. Punishment can be a motivator for change, but so can positive reinforcement. This could be an important point to expand upon within the context of the paper.

Paper #4: "Applying Good Health and Safety Management at Operational Incidents: A Dilemma?" by Author Andrew Strawson

Author Andrew Strawson explores whether the existence of immediate needs and pressures at operational incidents conflicts with health and safety management techniques for the fire and rescue service. He suggests that although there are internal and external pressures to perform, safety management techniques can and should be applied to all operational incidents. The author further indicates that competence, realistic training, and controlling risk to an acceptable level are key components of safety management.

My observations concerning his work include:

1. In the United Kingdom, significant emphasis is placed on risk management. Analyzing and managing risk within all aspects of the mission seems to have been culturally institutionalized within their fire service. Risk management, in this context, can and should be more thoroughly embraced by the American fire service. It translates directly to the safety of firefighters in all strategic, tactical, and task decisions. Perhaps more than any other point made in this paper, this risk management concept could have the most impact on decreasing firefighter line of duty deaths and injuries in the United States.
2. In order to improve the performance of decision-makers and those performing tasks at emergency incidents, managing one's composure is a trait that should be integrated into all aspects of training for firefighters and fire officers. Psychological and emotional training is at the center of teaching composure to firefighters and fire officers. The actions of firefighters and fire officers arriving at emergency incidents can be more effectively aligned with a risk model if the participants are under control of themselves emotionally and thinking clearly before and as they decide or act. When the level of risk being taken clearly exceeds the operational gain that might be achieved by those actions, composure and the state of mind of the decision-makers is sometimes a root cause of these decisions. These concepts involving emotional and psychological training could have been explored in more detail by the author.

Conclusion

RS06 provided a forum for attendees and presenters to learn and think critically about key issues that impact firefighter line of duty deaths. Each of the papers was thorough and thought-provoking. The authors provided conclusions and direction through their research, findings, and recommendations that could improve the safety of firefighters and the delivery of the mission of fire departments. I am fortunate to have had the opportunity to participate and encourage fire service members to engage in this process by preparing papers for publication in the International *Fire Service Journal of Leadership and Management* and/or for presentation at RS07.

About the Author

Chief Dennis Compton is a well-known speaker and the author of several books including the *When In Doubt, Lead!* series, *Mental Aspects of Performance for Firefighters and Fire Officers,* as well as many articles and other publications. He is also the Co-Editor of the current edition of the International City/County Management Association textbook entitled, *Managing Fire and Rescue Services.* Chief Compton serves as a national advocate and executive advisor for the fire service and homeland security organizations. Dennis served as the Fire Chief in Mesa, Arizona, for five years and as Assistant Fire Chief in the Phoenix, Arizona Fire Department, where he served for twenty-seven years. Chief Compton is the Past Chair of the Executive Board of the International Fire Service Training Association (IFSTA), Past Chair of the Congressional Fire Services Institute's National Advisory Committee, Chair of the Board of Directors of the Home Safety Council (HSC), and Vice Chair of the National Fallen Firefighters Foundation Board of Directors.

Anthony E. Brown, Associate Professor, Department of Political Science and Director, Fire and Emergency Management Program

Introduction

Comments from the experts who have preceded me have been very insightful. And being last to comment on the papers presented at this year's Symposium, I am tempted simply to say that everything important has already been said and take my seat. But I am not going to yield to that temptation immediately. I first would like to offer a few observations about the presentations we have heard today before taking my seat.

I will not spend my time describing my detailed editorial comments. I will forward these to the authors for their consideration. What I will do, however, is to describe what I consider to be the major issues and questions raised by the papers regarding our knowledge about firefighter line of duty deaths and injuries.

Overview

First, I wish to preface my comments with a brief overview and comparison of the papers presented today. The papers fit together well and provide us with a well-rounded view of issues related to our Symposium theme. The DeIorio and Malo paper and the Wieder and Roche paper address two major causes of firefighter deaths — poor health and fitness and vehicular collisions. And both papers suggest that the solution is changes in policies and procedures.

The Pessemier paper and the Strawson paper raise related but somewhat different issues. Both accept the need for better policies and procedures, but the focus of their research is on the obstacles that prevent the development and implementation of policies and procedures that mitigate the causes of death and injury. Pessemier focuses on changing the cultural foundation from which policies and procedures are developed and implemented. In his view, changes in policies and procedures may be necessary but are not sufficient to reduce injury and death rates. He concludes that the organizational culture in the fire service is a major cause of the high rates of firefighter deaths and injuries. The implication is that changes in policies and procedures may not be effective remedies unless the general culture in the fire service is changed first. What is needed is the development of a safety culture to replace the current culture that encourages and rewards high-risk behavior and tolerates conditions that contribute to the problem.

The Strawson paper addresses issues related to the implementation of a safety culture in the fire service. He emphasizes the conflict between the fire service culture or context and efforts to adopt policies and procedures compatible with a safety culture. He raises a fundamental question: Do operational pressures in the fire service conflict with good health and safety management techniques? His focus is on the dilemmas faced by fire administrators seeking to implement a safety culture when faced with internal and external resistance to change.

Themes and Issues

The papers illustrate what I consider to be four major themes relevant to the development of a solid research foundation for the organization and operation of the fire service. First, we need to avoid the trap of "organizational narcissism," a term used in Pessemier's discussion of organizational culture. Here I use the term to refer to the tendency to consider problems in the fire service as unique to the fire service.

Trainers and educators who work with firefighters have been heard to admonish their students to "get their nose out of the fire hose." In relating this perspective to fire safety, the point is that the fire service is not the only high-risk career in the U.S. There are lessons to be learned by researching the experiences of other high-risk professions both here and abroad. As Pessemier notes, other high-risk industries in the U.S. have developed a safety culture. Why not in the U.S. fire service? This is a question that deserves more systematic research.

On the other hand, it is important to identify the unique features of the fire service to understand the safety issue. This is a second theme illustrated in the research presentations. The point is well stated in the Strawson paper. He identifies the unique features of the U.S. fire service and notes their importance in better understanding the feasibility of adopting greater safety measures. Fire managers face difficult dilemmas as they balance the demand for quick response with health and safety management techniques that minimize risk. More empirical research is needed to better understand how an acceptable level of risk is determined.

A third theme is the need to relate research on problems and issues facing the fire service to other research traditions in the social sciences. The Pessemier paper provides an excellent review of the research literature on organizational culture and safety culture. In doing so, the issue of safety in the fire service is grounded in a broader research tradition. At the same time, direction is give to further research. His research suggests that we need a more thorough understanding of the fire culture as well as a clearer picture of what a safety culture in the fire service means in terms of human behavior.

Finally, the papers illustrate the importance of well-designed and systematic research projects in furthering our knowledge about safety in the fire service. Anecdotal evidence, though important in getting our attention, is not sufficient for drawing broader generalizations

about problems and issues in the fire service. The Malo and DiIorio paper provides empirical evidence of what is actually happening in fire service organizations regarding the physical fitness problem. The Wieder and Roche paper analyzes the disproportionate number of fatalities associated with tanker collisions and raises several researchable questions that would improve our knowledge of the problem. The research presented today contributes to a better understanding of safety problems facing the fire service in the U.S. And clearly understanding the problem is a prerequisite to the development of effective solutions.

About the Author

Dr. Anthony Brown is the Director of the graduate program in Fire and Emergency Management Administration in the Department of Political Science at Oklahoma State University. He holds Ph.D. and Master of Public Administration degrees from the University of Tennessee—Knoxville. Dr. Brown's teaching and research interests are in the fields of public management, state and local government, and intergovernmental relations. He can be contacted at: **anthony.brown@okstate.edu.**

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